FINAL ENVIRONMENTAL ASSESSMENT

PREDATOR DAMAGE AND CONFLICT MANAGEMENT IN MONTANA

Prepared by:

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA)
ANIMAL AND PLANT HEALTH INSPECTION SERVICE (APHIS)
WILDLIFE SERVICES (WS) – MONTANA

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in cooperation with:

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List of Acronyms Used

AFWA	Association of Fish and Wildlife Agencies
APHIS	Animal and Plant Health Inspection Service
APHIS-WS	APHIS, Wildlife Services
ARM	Administrative Rules of Montana
ATV	All-Terrain Vehicle
AVMA	American Veterinary Medical Association
BE	Bitterroot Ecosystem
BLM	Bureau of Land Management
BMP	Best Management Practices
BO	Biological Opinion
BOR	Bureau of Reclamation
CDC	Centers for Disease Control and Prevention
CEQ	Council on Environmental Quality
CFR	Codes of Federal Regulations
CPUE	Catch per Unit Effort
CSKT	Confederated Salish and Kootenai Tribes
CVM	Contingent Valuation Method
CWD	Chronic Wasting Disease
CYE	Cabinet-Yaak Ecosystem
dB or dBA	Decibels or A-weighted decibels (metric for sound)
DMA	Demographic Monitoring Area
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ERMA	Extensive Recreation Management Area
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FY	Fiscal Year
GHG	Greenhouse Gas
GYE	Greater Yellowstone Ecosystem
IPDM	Integrated Predator Damage Management
IUCN	International Union for Conservation of Nature
IWDM	Integrated Wildlife Damage Management
I&E	Immobilization and Euthanasia
LMU	Mountain Lion Management Unit
LRMP	Land and Resource Management Plan
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MDA	Montana Department of Agriculture
MDOL	Montana Department of Livestock
MFWP	Montana Fish Wildlife and Parks
MIS	Management Information System

MLLB	Montana Livestock Loss Board
MOU	Memorandum of Understanding
MRA	Minimum Requirements Analysis
MUSYA	Multiple Use Sustained Yield Act
NASS	National Agriculture Statistics Service
NCDE	Northern Continental Divide Ecosystem
NED	National Economic Development
NEPA	National Environmental Policy Act
NF	National Forest
NG	National Grassland
NHPA	National Historical Preservation Act
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRM	Northern Rocky Mountains
NTSB	National Transportation Safety Board
NWRC	USDA-APHIS-WS National Wildlife Research Center
OIG	USDA Office of Inspector General
OMB	Office of Management and Budget
PCA	Primary Conservation Area
PDM	Predator Damage Management
RMA	Recreation Management Area
RMP	Resource Management Plan
SMA	Special Management Area
SOP	Standard Operating Procedure
SRMA	Special Recreation Management Area
TCM	Travel-Cost-Method
TTD	Trap Tranquilizer Device
TWS	The Wildlife Society
T&E	Threatened and Endangered
USACE	US Army Corps of Engineers
USC	United States Codes
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WA	Wilderness Area
WDM	Wildlife Damage Management
WID	Work Initiation Document
WP	Work Plan
WS	Wildlife Services
WSA	Wilderness Study Area
WS-Montana	Montana Program of USDA-APHIS-Wildlife Services
WTP	Willingness-to-Pay

1. Purpose and Need

1.1 Introduction

This chapter provides the foundation for:

- Understanding why wildlife damage occurs and the practice of wildlife and predator damage management;
- Knowing the statutory authorities and roles of federal and state agencies in managing damage caused by predators in Montana;
- Understanding how WS-Montana cooperates with and assists private and commercial resource owners and federal, tribal, state, and local government agencies in managing predator damage;
- Explaining the framework for the scope of this National Environmental Policy Act (NEPA) document, the rationale for preparing an environmental assessment (EA), program goals, and decisions to be made by WS-Montana;
- Understanding the reasons why private and commercial entities, tribes, and federal, state, and local government agencies request assistance from WS-Montana;
- Understanding the effectiveness and cost-effectiveness associated with predator damage management in the United States; and
- Explaining the public involvement and notification processes used by WS-Montana for this EA.

Chapter 2 identifies the issues analyzed in detail in this EA and describes the proposed action and alternatives evaluated in detail, with the rationale why some alternatives are not considered in detail, as required by the Council on Environmental Quality (CEQ) implementing regulations for NEPA at 40 CFR 1502.14(a). Details of the different wildlife damage management (WDM) methodologies are included in Appendix A. Chapter 3 provides the detailed comparative analysis of the direct, indirect, and cumulative impacts of the proposed action and alternatives on the quality of the human environment.

1.2 In Brief, What is this EA About?

Wildlife Services (APHIS-WS), a program within the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS), provides federal professional leadership and expertise in resolving wildlife conflicts to help create a balance that allows people and wildlife to coexist (USDA Wildlife Services 2018c)(Directive 1.201).

APHIS-WS recommends and/or implements a cohesive integrated wildlife damage approach, which incorporates biological, economic, environmental, legal, and other information into a wildlife damage management decision-making process (USDA Wildlife Services 2014b), and includes many methods for managing wildlife damage, including non-lethal and lethal options. Although non-lethal methods are considered first, responsible wildlife damage management sometimes requires lethal control to meet cooperators' objectives. In addressing conflicts between wildlife and people, consideration must be given not only to the needs of those directly affected by wildlife damage but also to a range of environmental, sociocultural, economic, and other relevant factors. Federal and state agency and private wildlife managers, including those working for APHIS-WS, must be experienced in evaluating the particular circumstances of the conflict including determining which predator species are involved and expertly implementing or recommending the most effective strategy using sustainable methods that balance those considerations.

Wildlife species can be biologically categorized in many ways. This EA focuses on species that are considered meat-eating predators, even if some of them eat food other than meat as part of their diet, and collectively refers to these species as "predators" (Table 1.1). Take can indicate lethal removal of the animal or transfer of custody to another entity such as the state's wildlife management agency.

The purpose of the EA is to facilitate WS-Montana's decision making regarding responses to requests for assistance from the public, agencies and tribes in managing damage caused by predators. This environmental assessment (EA) evaluates the impacts of alternative approaches to managing predator damage in Montana, including the current Integrated Predator Damage Management (IPDM) alternative. The alternatives considered in this EA vary regarding the degree of WS-Montana involvement in predator damage management, the degree of technical assistance (advice, information, education, and/or demonstrations) and of operational field assistance (active management of offending predators), and the degree of lethal and non-lethal methods available for use. This EA also provides sufficient analysis of environmental impacts to determine if a Finding of No Significant Impact (FONSI) or an environmental impact statement (EIS) is appropriate.

Integrated wildlife damage management (hereafter, IWDM) describes the concurrent or consecutive use of a range of methods to manage damage caused by any wildlife species (not just predators). WS-Montana assistance provided to requesters for managing predator damage evaluated in this EA is simply a component of all WS-Montana wildlife damage management activities conducted in the state. APHIS-WS has determined that PDM is sufficiently different from other APHIS-WS activities as to warrant separate NEPA analysis. Therefore, this EA is limited to PDM. Other WS-Montana activities which might impact predator species will be included in the analyses herein (e.g., population impact analyses in Section 3.5), because these are connected actions. For example, if a native predator was taken as a non-target during an attempt to manage birds or aquatic rodents, that take will be included in this EA. NEPA analyses of other components of WS-Montana activities that do not involve predators are evaluated in separate documents.

WS-Montana's goal for IPDM, as currently conducted, is to manage predator damage, threats of damage, and risks to human/pet health and/or safety by responding to all requests for assistance, including technical assistance and/or direct operational assistance, regardless of the source of the request.

WS-Montana proposes to continue responding to requests for assistance in protecting livestock, property, and human/pet health and safety from managing damage by predators, and requests for data on wildlife diseases from agencies and researchers. The

EA includes an analysis of the impacts associated with WS-Montana continuing to assist in predator damage management on all land classes, in rural, urban, and suburban areas by agreement as requested. The EA also includes analyses of impacts of four other levels of predator damage management activities in Montana both involving and not involving WS-Montana.

The proposed action (Alternative 1; Section 2.3.1 and Appendix A), involves WS-Montana continuing to use all appropriate methods, singly or in combination, to resolve damage caused by the predator species included in this EA. These methods include cultural practices such as shed lambing, herding, and guard animals; habitat and animal and behavior modification such as exclusion, chemical repellents, and hazing with pyrotechnics; and lethal operational actions such as trapping and shooting. In most situations, the requestor/cooperator are responsible for implementation of non-lethal methods, such as exclusion-type barriers, and some lethal methods, consistent with state law. Resource owners that are given direct predator damage management assistance by WS-Montana are encouraged to use reasonable and effective non-lethal management strategies and sound husbandry practices, when and where appropriate, to reduce ongoing and potential future conflict situations.

Predator damage management is conducted by WS-Montana only where a property owner or manager, including government, tribal, commercial, organizational, or private entity, has requested assistance and Work Initiation Documents (WIDs), Memoranda of Understanding (MOUs), Interagency Agreements, Cooperative Service Agreements, and/or Work Plans are in place to coordinate work.

All WS-Montana actions are conducted in accordance with applicable federal, state, tribal, and local laws, and in accordance with current MOUs and other agreements between WS-Montana and federal, state, and tribal agencies. WS-Montana cooperates with Montana Fish, Wildlife, and Parks (MFWP), the Montana Department of Livestock (MDOL), the Montana Livestock Loss Board (MLLB), the U.S. Fish and Wildlife Service (USFWS), the U.S. Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the Confederated Salish and Kootenai Tribes, and the Blackfeet Nation as appropriate, for actions involving predator damage management.

See Sections 2.3.1 through 2.3.5, and Appendix A for details on the five alternatives evaluated in this EA, and Chapter 3 for their associated impacts.

1.3 What Species are Included in this EA?

This EA includes the following predator species (Table 1.1; in order of proportion of take by WS-Montana). All species except for free-ranging/feral dogs and cats and grizzly bears (primarily managed by the USFWS as an endangered species) are managed under state law by MFWP. Predatory animals are defined under Montana Code Annotated (MCA) §81-70-101 as coyotes, red fox, and any other individual animal causing depredations upon livestock as also managed by MDOL. Montana Code Annotated (MCA) §87-2-101 also defines predatory animals managed by MFWP as coyotes, weasel, skunk, and civet cat.

Table 1.1. Predator Species Included in Scope of this EA (listed in order of importance in terms of the number of PDM actions by WS-Montana).

Common Name	Scientific Name	**Management Authority**[1]
Coyote	*Canis latrans*	**MFWP & MDOL**
Red fox	*Vulpes vulpes*	**MFWP & MDOL**
Raven	*Corvus corax*	**USFWS/MFWP**
Gray wolf	*Canis lupus*	**MFWP**
Mountain Lion	*Felis concolor*	**MFWP**
Black bear	*Ursus americanus*	**MFWP**
Striped skunk	*Mephitis mephitis*	**MFWP**
Badger	*Taxidea taxus*	**MFWP**
Grizzly Bear	*Ursus arctos horribilis*	**USFWS**
Raccoon	*Procyon lotor*	**MFWP**
Free-ranging/feral dog	*Canis familiaris*	**Local Officials**
Feral Cat	*Felis catus*	**Local Officials**
Bobcat	*Lynx rufus*	**MFWP**
Feral Swine	*Sus scrofa*	**MDOL**

[1] Management is collaborative and further described by species in Section 3.5
MFWP: Montana Fish, Wildlife and Parks
MDOL: Montana Department of Livestock
USFWS: U.S. Fish and Wildlife Service

1.4 What is Wildlife Damage Management?

1.4.1 Why Do Wildlife Damage and Risks to Human Health and Safety Occur?

Wildlife are valuable natural resources, long valued by the American public for aesthetic, recreational, and emotional reasons; their attendant economic benefits are important in many communities. Native wildlife in overabundance or individual animals that have learned and habituated to use resources supplied by humans, especially food, can come into conflict with humans. Introduced, feral, or invasive species may outcompete native species and cause damage to other resources. Wildlife can destroy crops and livestock, damage property and natural resources, including other species valued by humans, and pose serious risks to public and pet health and safety.

Across the United States, wildlife habitat has been substantially changed as human populations expanded and land use and impacts change. These human uses and needs often compete with the needs of wildlife, which increases the potential for conflict. With this continued and more intensive use of land by humans, introduction of domestic livestock, water resource management, urbanization, and other modern agricultural, cultural, and transportation practices associated with human development have caused substantial changes in the ways that humans and wildlife, especially predators, interact.

Highly adaptable and flexible species often reach unnaturally high densities. Some animals and localized populations may adapt to change by using human infrastructure or concentrated agricultural practices for their life cycle needs, such as obtaining food and water, finding areas to breed or rest. Conflicts include threats to human health and safety.

Wildlife may serve as reservoirs for disease and parasites. Diseased animals living near areas of human activity may transmit those diseases to livestock, people, and/or pets.

These diseases may transfer to people directly through physical contact or may be transmitted to people via environmental contamination by feces and even tainted food products such as fresh produce or meat products.

The wild animals themselves do not perceive the same values that humans perceive in the animals or plants they eat, the locations they choose to breed and live, or the health or safety concerns they cause to humans. They are simply using and adapting to the available habitats, including opportunities where humans provide easy food and living space. The ability of wild animals to adapt to changes in their environment for meeting their own needs for food, water, and shelter can create tension and conflict where human needs for social and economic security and health and safety overlap.

1.4.2 In what ways do humans value wildlife?

Schwartz et al. (2003) summarize that human attitudes towards large carnivores have evolved over time in Europe and North America from threats to life and property to utilitarian considerations, to appreciating their intrinsic values. Human perceptions, attitudes, and emotions differ depending on how humans desire to "use" different wildlife species and how they interact with individual or groups of animals. For example: seeing a group of deer in a field at dusk may be seen as a positive experience, while seeing the same group of deer feeding in your garden or commercial alfalfa field is frustrating; watching a coyote feeding on rodents in the snow may be exciting, while having the same coyote foraging for food near or on your pets or farm animals may be highly undesirable and even frightening.

Cultural perceptions based on experience, upbringing, or folklore about predators may evoke negative emotions toward wolves or coyotes because they kill and eat animals we like or because they scare us; they may also evoke positive feelings because they look and behave like domestic dogs, or symbolize wildness (Table 1.2).

Table 1.2. Basic Wildlife Values (Adapted from Kellert (1994) and (Kellert and Smith 2000)).

Term	Definition
Aesthetic	Focus on the physical attractiveness and appeal of wild animals
Dominionistic	Focus on the mastery and control of wild animals
Ecologistic	Focus on the interrelationships between wildlife species, natural habitats, humans, and the environment
Humanistic	Focus on emotional affection and attachment to wild animals
Moralistic	Focus on moral and spiritual importance of wild animals
Naturalistic	Focus on direct experience and contact with wild animals
Negativistic	Focus on fear and aversion of wild animals
Scientific	Focus on knowledge and study of wild animals
Utilitarian	Focus on material and practical benefits of wild animals

Lute and Attari (2016) recognize that conflicts with wildlife have been ongoing, especially as humans have made and continue to make substantial modifications to the environment and land uses that have created such conflicts, and that lethal control may be more cost-effective than sweeping habitat protection strategies. Their study suggests that people may rely on default strategies such as habitat and ecosystem protection and moral considerations rather than also considering economic and social costs necessary for navigating difficult trade-offs and nuances inherent in decision-making.

Manfredo et al (2018) compared survey data from 2004 and 2018 to detect potential shifts in wildlife values on a statewide level. The value categories were traditionalist (dominionistic/utilitarian), mutualist (humanistic/moralistic), pluralist (situationally dependent), and distant (low level of interest in wildlife). In Montana the review showed a decrease in traditionalist views (-8.5%), and increases in mutualist (7.5%), pluralist (0.5%), and distant (0.5%) views (Manfredo et al. 2018).

Trade-offs can and do occur between different conservation objectives and human livelihoods and conservation (McShane et al. 2011). The authors argue that many options exist in managing wildlife conflict in relation to protection of individual animals, populations, ecosystems, and human physical and economic well-being, and that these choices are "hard" because every choice involves some level of loss.

1.4.3 At What Point Do People or Entities Request Help with Managing Wildlife Damage?

As a society, our attitudes have changed over time, and now those same species seen as conflicting with human values may be considered desirable, but even then, only under socially acceptable circumstances. The tension regarding the use of public funds and/or lands to support a wide variety of private/individual uses or incomes (not only related to wildlife) is a federal and/or state governmental policy consideration. An example of this tension can involve individuals who believe, for example, that livestock producers should not be allowed to graze on public lands or that livestock losses to predation should be considered a "cost of doing business."

Animals cause damage to property, agriculture, economic security, threaten the sustainability of managed or protected wildlife species, and/or threaten human and pet health and safety. When this occurs, there are many situations when people, government agencies, or commercial interests request private companies or federal or state governments to stop or reduce the damage by removing or dispersing the individual animals or local groups of animals causing the problems. When damage or losses have previously occurred and can be expected to occur again, people or agencies may request that animals or local groups of animals be removed or dispersed to avoid further losses, even before the damage or losses reoccur. Often, without outside help, people or entities will try to resolve the problems themselves, sometimes by attempting to prevent the damage from re-occurring, such as by building fences and other infrastructure, or by killing animals that may, or may not, be causing the problem by using traps, firearms, or toxic chemicals.

The term "damage" in the case of IWDM is consistently used to describe situations where the individual person or entity has determined that the losses caused by wildlife triggers their threshold for requesting assistance or attempting to take care of the problem themselves. "Damage" may be defined as economic losses to property or assets, or threats to human or pet safety. However, "damage" may also be defined as a loss in the aesthetic value of property and other situations where the behavior of wildlife is no longer tolerable to an individual person or entity.

The threshold triggering a request for assistance in dealing with a particular damage situation is often unique to the individual person, entity, or agency requesting assistance. Therefore, what constitutes damage to one person or entity and considered intolerable may not even be considered a problem by another individual or entity.

Addressing wildlife damage problems requires consideration of both the resource owners' and society's levels of acceptability and tolerance, as well as the ability of ecosystems and local wildlife populations to absorb change without short- or long-term adverse impacts.

Biological carrying capacity is the maximum number of animals of a given species that can, in a given ecosystem, survive through the least favorable conditions occurring within a stated time interval (in other words, the largest number of animals that can sustainably survive under the most restricting ecological conditions, such as during severe winters or droughts. The cultural carrying capacity, is the limit of human tolerance for wildlife or its behavior, often expressed as the density of a given species that can coexist compatibly with a given local human population. For some, just the presence of wild animals may be considered threatening, or a nuisance to people with low tolerance or when the animals are viewed as cruel, aggressive, or frightening. These phenomena are especially important because they define the sensitivity of a communities to coexisting with wildlife.

While the biological carrying capacity of the habitat may relatively high, in many cases, the wildlife acceptance capacity of people sharing that habitat is lower. Once the wildlife acceptance capacity is met or exceeded in a particular circumstance, people take or request help for taking action to alleviate the damage or address threats.

1.4.4 What Are the Science and Practices of Wildlife Damage Management?

With new science and changing societal values, governmental policies have changed to the extent that native wildlife populations are no longer managed by local, state, and the Federal Government for population suppression, extirpation from local areas, or even entire removal over large areas or regions, unless such management meets local objectives of protecting other valued or rare wildlife populations or for reducing the threat of the spread of disease. Wildlife damage management focuses on addressing a specific situation, not broad-scale population management. The Wildlife Society (TWS), a non-profit scientific and educational association that represents wildlife professionals, recognizes that wildlife damage management is a specialized field within the wildlife management profession, and that responsible wildlife management, including IWDM, requires adherence to professional standards.

The Wildlife Society has the following standing position on Wildlife Damage Management (The Wildlife Society 2016):

> "Prevention or control of wildlife damage, which often includes removal of the animals responsible for the damage, is an essential and responsible part of wildlife management…
>
> Wildlife sometimes causes significant damage to private and public property, other wildlife, habitats, agricultural crops, livestock, forests, pastures, and urban and rural structures. Some species may threaten human health and safety or be a nuisance. Prevention of control of wildlife damage, which often includes removal of the animals responsible for the damage, is an essential and responsible part of wildlife management. Before wildlife damage management programs are undertaken, careful assessment should be made of the problem, including the impact to individuals, the community, and other wildlife species. Selected techniques should be incorporated that will be efficacious, biologically selective, and socially appropriate.
>
> The policy of The Wildlife Society in regard to wildlife damage management and the alleviation of wildlife problems is to [in part]:…Recognize that wildlife damage management is an important part of modern wildlife management."

IWDM involves considering and applying options, tools, and techniques, either singly or in combination, for resolving the damage or threat of damage using a strategy that is sustainable and appropriate to the specific project circumstances in a way that minimizes economic, health, and environmental risks. Sustainable wildlife management is defined as "the sound management of wildlife species to sustain their populations and habitat over time, taking into account the socioeconomic needs of human populations" (Food and Agriculture Organization of the United Nations 2014). When managing wildlife to meet certain objectives related to damage or threats caused by species identified as "predators," it is called integrated predator damage management (IPDM).

The APHIS-WS program uses the IWDM approach (APHIS-WS Directive 2.105) in which a combination of methods may be used or recommended to reduce wildlife damage. The challenge is to develop strategies that include the most effective combination of techniques. For example: separating resources to be protected from wild animals known, or considered likely to, damage that resource; removing animals responsible for damage; harassing damaging animals away from the resources to be protected, and educating the resource owner on coexistence, possibly by removing or carefully managing the resource to be protected.

Per APHIS-WS Directives 2.101 and 2.105, when selecting and applying a particular method or methods, "consideration must be given to the species responsible and the frequency, extent, and magnitude of damage. In addition to damage confirmation and assessment, consideration must be given to the status of target and potential non-target species, local environmental conditions, relative costs of applying management techniques, environmental impacts, and social and legal concerns."

APHIS-WS Directive 2.105 states:

> "The WS program applies the IWDM (commonly known as Integrated Pest Management) approach to reduce wildlife damage. As used and recommended by the WS program, IWDM encompasses the integration and application of all

approved methods of prevention and management to reduce wildlife damage. The IWDM approach may incorporate cultural practices, habitat modification, animal behavior management [such as repellents, frightening devices, and physical exclusion], local population reduction [such as removing offending animals or groups of animals] or a combination of these approaches.

The selection of wildlife damage management methods and their application must consider the species causing the damage and the magnitude, geographic extent, duration, frequency, and likelihood of recurring damage. In addition, consideration is given to non-target species, environmental conditions and impacts, social and legal factors, and relative costs of management options. WS personnel shall apply and use the IWDM approach to efficiently and effectively prevent or reduce damage caused by wildlife. In applying IWDM to wildlife damage management, the WS program may offer technical assistance, direct assistance, or a combination of both in response to requests for help with wildlife damage problems."

1.5 What Are the Roles of USDA APHIS Wildlife Services in IWDM?

APHIS-WS provides federal professional leadership and expertise to resolve wildlife conflicts to help create a balance between the needs of people and wildlife. APHIS-WS applies and recommends a cohesive integrated approach, which incorporates biological, economic, environmental, legal and other information into a transparent wildlife damage management decision-making process, and includes many methods for managing wildlife damage, including non-lethal and lethal options.

The APHIS-WS mission "…to provide federal leadership in managing conflicts with wildlife" includes resolution of wildlife conflicts in rural and urban areas; conservation of natural resources (including threatened and endangered species, and managed wildlife populations), protection of public, private and commercial property and assets; and control of invasive species and wildlife disease vectors. Increasingly, APHIS-WS is responsible for minimizing wildlife threats to public health and safety, as well as to the Nation's vital agricultural base.

APHIS-WS' success is based in its combined programs of integrating fieldwork (operations) with state-of-the-art research of applied wildlife damage management principles and techniques. APHIS-WS' National Wildlife Research Center (NWRC), internationally recognized as a leader in wildlife damage management science. Scientists and support staff are dedicated to finding solutions to challenging wildlife damage management problems related to agriculture, natural resources, property, and human health and safety. NWRC conducts research and develops tools to address dynamic wildlife damage management challenges. APHIS-WS operations personnel and NWRC researchers work closely together. This ensures that APHIS-WS will continue to resolve wildlife conflicts as effectively and humanely as possible, using advanced science and technology.

NWRC applies scientific expertise to the development of practical methods to resolve these problems and to maintain the quality of the environments shared with wildlife. NWRC designs studies to ensure that the methods developed to alleviate animal damage are biologically sound, effective, safe, economical, and acceptable to the public. NWRC scientists produce and test the appropriate methods, technology, and materials for reducing animal damage. Through the publication of results in peer-reviewed scientific literature and the exchange of technical information by other means, the NWRC provides valuable information to the public and the scientific community, as well as to APHIS-WS' operations.

1.5.1 What is the Federal Law Authorizing Wildlife Services' Actions?

APHIS-WS is the federal agency authorized by Congress to protect American resources from damage associated with wildlife. The Animal Damage Control Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 8351-352) states:

> "The Secretary of Agriculture may conduct a program of wildlife services with respect to injurious animal species and take any action the Secretary considers necessary in conducting the program….

The Act was amended in 1987 (Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 8353) to further provide:

> On or after December 22, 1987, the Secretary of Agriculture is authorized, except for urban rodent control, to conduct activities and to enter into agreements with state, local jurisdictions, individuals, and public and private agencies, organizations, and institutions in the control of nuisance mammals and birds and those mammal and bird species that are reservoirs for zoonotic diseases, and to deposit any money collected under such agreement into the appropriation accounts that incur the costs to be available immediately and to remain available until expended for Animal Damage Control activities."

The agency is funded by Congressional appropriations and by funds provided by governmental, commercial, private, and other entities that enter into agreements with APHIS-WS for assistance.

1.5.2 How does APHIS-WS Carry Out Its Mission?

1.5.2.1 What Are APHIS-WS' and WS-Montana's Mission, Goals, and Objectives?

1.5.2.1.1 APHIS-WS' Mission

APHIS-WS' mission is to provide professional federal leadership and expertise to resolve wildlife conflicts to allow people and wildlife to coexist. The agency is funded by Congressional appropriations and by funds provided by governmental, commercial, private, and other entities that enter into an agreement with APHIS-WS for assistance. For Example, in Montana during FY 2018, IWDM activities were funded by Congressional appropriations (58.3%), state interagency agreements (15.6%), and private cooperators and livestock and sportsmen's associations (24.2%). Cooperators are always responsible for contributing a proportion of the costs, including WS-Montana administrative overhead. In the event that feral swine are discovered in Montana, APHIS-WS' Feral Swine Damage Management Program would provide federal funding at the WS-Montana State Director's request for a Strategic Local Project with the goal of eradication (USDA Animal and Plant Health Inspection Service et al. 2015). MDOL would also provide funds for a feral swine eradication program if federal funds are not available or sufficient (MCA § 81-29-106).

APHIS-WS' stated mission, developed through a strategic planning process, is:

- "To provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and
- To safeguard public health and safety (APHIS-WS Directive 1.201).

To facilitate long-term strategic planning, APHIS-WS identified a list of core program functions in the APHIS-WS 2020-2024 Strategic Plan (U.S. Department of Agriculture 2019), including these functions relevant to WS-Montana:

- Predation management for the protection of livestock
- Protection of agricultural resources and property from wildlife damage
- Single, residential wildlife control requests
- Airport wildlife hazard management
- Conducting wildlife damage research
- Emergency response functions/monitoring and surveillance of zoonotic diseases

Directive 3.101 states:

> "APHIS-WS is specifically authorized to enter into cooperative programs with Government agencies, public or private institutions, organizations associations or private citizens to manage conflicts with wild animals. By coordinating Federal Government involvement in managing wildlife conflicts and/or damage, WS officials help ensure that wildlife management activities are environmentally sound and conducted in compliance with applicable Federal, State, and local laws and regulations, including two significant environmental laws, the Endangered Species Act and the National Environmental Policy Act (NEPA)."
>
> "Wildlife Services' successes in developing and providing its expertise in WDM methodologies, and strategies have increasingly created methodologies, strategies, and opportunities for private industry to provide similar WDM services. WS activities are differentiated from commercial WDM activities by among other things, adherences to the environmental protection requirements promulgated under NEPA….WS may implement methods approved exclusively for WS personnel who are the only individuals, public or private, that are trained and certified in their use. WS cooperates with private businesses by: 1) providing technical training at State, regional, and national conferences; 2) developing certain WDM methods and registering certain chemical or pesticide WDM products for use by the industry and the public, and 3) assisting businesses by applying WS-specific management methods when requested."

The APHIS-WS program carries out its federal mission for helping to solve problems that occur when human activity and wildlife are in conflict with one another through:

- Providing training to governmental and commercial wildlife damage management professionals when requested;
- Developing and improving strategies to reduce economic losses and threats to humans from wildlife;
- Collecting, evaluating, and disseminating information on wildlife damage management techniques;
- Responding to requests for assistance with wildlife damage management situations, including providing technical advice and a source for loaned, limited-use management materials and equipment such as cage traps and pyrotechnics; informing and educating the public and cooperators on how to avoid or reduce wildlife damage; and/or addressing the problem through direct action.

1.5.2.1.2 WS-Montana Goals and Objectives

The goal of WS-Montana is to meet the APHIS-WS mission of professionally supporting the coexistence of humans and wildlife by conducting IPDM. WS-Montana staff consistently respond to all requests for assistance to meet the following components of the goal by:

- Responding in a timely and appropriate way to all requests for assistance.
- Providing that responses, whether over the phone, or conducted in the field, follow the formal decision process of the APHIS-WS Decision Model as specified in APHIS-WS Directive 2.201, Section 2.3.1.2 (hereafter called the Decision Model)(Slate et al. 1992, USDA Wildlife Services 2014b) to evaluate, formulate, and implement or recommend the most effective IPDM strategy.
- Recommending IPDM strategies that effectively reduce or eliminate damage and risks caused by the offending animal(s) to resolve conflicts with humans and their valued resources, health, and safety.

These IPDM strategies may be both short- and/or long-term, and are often a combination of lethal and/or non-lethal methodologies to ensure maximum effectiveness, selectivity and humaneness.

The WS-Montana objectives are to:

- Professionally and proficiently respond to all reported and verified losses or threats due to predators using the IPDM approach using the Decision Model. IPDM must be consistent with all applicable federal, state, and local laws, APHIS-WS policies and directives, cooperative service agreements, MOUs, and other requirements as provided in any decision resulting from this EA.
- Implement IPDM such that cumulative effects do not negatively affect the viability of any native predator populations.
- Ensure that actions conducted within the IPDM strategy fall within the management goals and objectives of applicable wildlife damage management

plans or guidance as determined by the jurisdictional state, tribal, or federal wildlife management agency.

- Minimize non-target effects by using the Decision Model to select the most effective, selective, and humane remedies available, given legal, environmental, and other constraints.
- Incorporate the use of appropriate and effective new and existing lethal and non-lethal technologies, where appropriate, into technical and direct assistance strategies.

APHIS-WS' activities are conducted in accordance with applicable federal, state, and local laws, Work Initiation Documents (WIDs), cooperative service agreements, (Section 1.8), Memoranda of Understanding (MOU) (Sections 1.8 and 1.9), and other applicable agreements and requirements, and the directives found in the WS Program Policy Manual, updated April 20, 2016 (https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_ws_program_directives). These documents establish the need for requested work, legal authorities allowing the requested work, and the respective responsibilities of APHIS-WS and its cooperators.

1.5.2.2 How Does APHIS-WS Ensure the Implementation of Professional IWDM Practices?

Each APHIS-WS state office carries out the APHIS-WS mission in accordance with the differing management goals and requests in its state. IWDM activities can include providing assistance with IWDM for the purposes of managing property and asset damage and losses, protecting special status wildlife, reducing or eliminating invasive species, protecting human health or safety, managing diseases that can be passed from wildlife to people or domestic animals (zoonoses), and conducting research.

Per APHIS-WS policy and practice, APHIS-WS State Directors and District Supervisors are professional wildlife biologists. Supervisors oversee teams of highly trained and specialized wildlife biologists, specialists, and other field personnel. Employee characteristics identified in the Code of Ethics (Directive 1.301) include commitment to compliance with legal requirements; honesty; integrity; accountability; continual learning and professional development; showing high levels of respect for people, property, wildlife, and varying viewpoints regarding wildlife and wildlife management; conservation of natural resources; using the most selective and humane methods available, with preference given to non-lethal methods when practical and effective; using the Decision Model to resolve IWDM problems; providing expertise on managing wildlife damage to the public upon request; and working in a safe and responsible manner.

All field personnel are experienced in wildlife management, competent, and are highly trained in a diversity of methods described in in detail in Appendix A, as needed and appropriate, and are trained with periodic refreshers, in:

- The safe and proficient use of firearms (WS Directive 2.615);
- The safe involvement in aerial operations (WS Directives 2.620 and 2.305);
- The safe and proficient use of explosives and pyrotechnics (WS Directive 2.625);

- The safe use and management of hazardous materials (WS Directive 2.465);
- The safe and compliant use of pesticides (WS Directive 2.401);
- The safe and proficient use of M-44s (WS Directive 2.415); and
- The safe and humane use of immobilizing and euthanizing drugs (WS Direct 2.430).
- The safety and health program (WS Directive 2.605)

Professional and state agencies, councils, and wildlife management organizations have recognized APHIS-WS and individual employees for their work in wildlife conservation as part of IWDM, including examples such as: the Alaska Department of Fish and Game Director's Stewardship Award; recognition for bird aircraft strike hazard work at Nellis Air Force Base; USFS 2016 Eastern Region Honor Award for work managing feral swine damage on the Wayne National Forest; Michigan Aeronautics Commission Award of Excellence; Michigan Department of Natural Resources 2015 Oscar Warbeck Award for outstanding partnership in managing BASH; USFWS 2016 recognition award for efforts leading to the return of the black-footed ferret to Meeteetse, WY; National Invasive Special Council 2015 Invasive Species Leadership/Aquatic Award; The Wildlife Society 2008 Caesar Kleberg Award for Excellence in Applied Wildlife Research; and the Wolf Recovery Foundation Alpha Award for achievements and contributions benefitting wolf recovery in multiple years. In addition, APHIS-WS received the 2014 Presidential Migratory Bird Federal Stewardship Award for non-lethal localized management of conflicts between raptors and humans.

APHIS-WS biologists and employees also regularly contribute to the development of new management methodologies, publish professional articles in respected scientific journals and popular publications, and provide presentations at professional conferences.

1.5.2.3 How Does APHIS-WS Operate?

APHIS-WS personnel respond to requests for assistance with problems, by reviewing the circumstances to determine whether wildlife caused the problem, and, if so, identifying which species of wildlife were involved. Recommendations are then made to the requester for one or more courses of action they can take to minimize the risk of further damage (APHIS-WS Directive 2.201). This first type of action is called "technical assistance" wherein APHIS-WS personnel recommend actions that can be implemented by the resource owner or manager, such as better fencing, closer husbandry of livestock, or removing the offending animal themselves compliant with applicable laws.

APHIS-WS field personnel may also act directly in response to a request for assistance, called Direct Assistance activities. These actions can include non-lethal techniques such as harassment and/or lethal measures that remove the offending animal(s), such as capturing them with specialized equipment and conducting euthanasia when needed. The actions can occur in urban or field settings, including secured and limited use areas such as military bases and airports. Before wildlife damage management of any type is conducted, a Work Initiation Document must be signed by a representative of WS-Montana and the land/resource owner or manager. For work on federal lands, an Annual

Work Plan is developed in coordination with the land management administrator or agency representative and WS-Montana to outline how work is to be conducted (per MOUs with the USFS and BLM, Section 1.8).

The APHIS-WS Directive 2.101 states:

> "When responding to requests for assistance, WS may provide technical assistance, direct control assistance, and/or research assistance. Technical and direct control assistance…may involve the use of either lethal or non-lethal methods, or a combination of the two. Preference is given to non-lethal methods when practical and effective."

Trained and experienced field personnel determine the appropriate IPDM methodologies to recommend and/or implement using the Decision Model to assess the problem; evaluate the effectiveness of the various IPDM methods available; recommend strategies based on short-term and long-term effectiveness and possible restrictions, constraints, and environmental considerations and costs; discusses the options with the cooperator; and formulates a strategy. WS then provides the appropriate assistance, and in collaboration with cooperators, monitors for effectiveness. The use of the Decision Model is discussed in more detail in Section 2.3.1.2.

The ultimate intent of APHIS-WS personnel responding to a request for assistance is to develop and, when appropriate, implement strategies to alleviate and/or avoid wildlife damage and threats to human/companion animal health or safety, using one or more of the following strategies:

- Manage the resource being damaged so it is more difficult for the wildlife to cause the damage.
- Manage the wild animals responsible for or associated with the damage in lethal and/or non-lethal ways so they cannot continue to cause damage and potentially train their young or conspecifics to cause such damage, and/or
- Create physical separation of the protected resource and the problem animals so that the damage is inherently minimized.

All APHIS-WS actions are consistent with applicable federal, state, and local laws and regulations (APHIS-WS Directive 2.201). All actions must be consistent with memoranda of understanding and agreements with federal and state agencies, such as MFWP, USFWS, USFS, or BLM, if the actions involve those agencies. Most importantly, as a federal agency, all APHIS-WS actions must be in compliance with the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Migratory Bird Treaty Act of 1918 (MBTA), and FIFRA, as well as the federal and state statutes and regulations discussed in this EA (Section 2.4.4) and in Appendix B.

When requested to assist with IPDM problems, the WS-Montana decision is whether or not to participate based on authority, jurisdiction, funding, and a professional determination of the scientific appropriateness and effectiveness of the proposed strategy. MFWP and MDOL are authorized to control the threat of predator-related damage to wildlife populations under their authority using hunting seasons and administrative removals of predators. The USFWS is authorized to manage ESA-listed species, migratory birds, and eagles (Section 2.4.4 and Appendix B). Therefore, when requested by MFWP, MDOL, or the USFWS to conduct IPDM for protection or management of species under their jurisdiction, especially if the requested action involves localized population reduction, WS-Montana evaluates the potential effectiveness and appropriateness of their involvement before making a final decision to assist. WS-Montana considers whether such actions would be strategically planned to occur at a specific time when the managed wildlife population is vulnerable to predation, such as during calving or lambing, and when population reductions are determined to be necessary on a temporary and short-term basis.

WS-Montana activities are described in detail in Section 2.3.1 (Alternative 1) and Appendix A.

1.6 What Actions Are Outside of the Authority of APHIS-WS?

It is important to remember that APHIS-WS does not have any authority to manage wildlife other than the authority provided by Congress for assisting with wildlife-caused damage (Animal Damage Control Act, DCA). APHIS-WS policy is to respond to requests for assistance with managing wildlife damage. Managing wildlife populations and even individual wild animals is under the legal jurisdiction of state wildlife agencies, the USFWS/National Marine Fisheries Service for ESA-listed species, the USFWS for migratory birds and eagles, and tribal governments on tribal lands, and APHIS-WS defers to the applicable laws.

APHIS-WS has no authority to determine national policy regarding use and commitment of local, state, tribal or federal resources or lands for economic use by private entities, such as livestock grazing, or timber growth and harvest, nor use of private lands such as for livestock feedlots, or government, commercial, or residential development.

APHIS-WS does not make public land-use management decisions. Policies that determine the multiple uses of public lands are based on Congressional acts through laws such as the Taylor Grazing Act of 1934 and the Federal Land Policy and Management Act (FLPMA) for the BLM, and the Forest Service Organic Act of 1897 and the Multiple Use-Sustained Yield Act of 1960 for the Forest Service. Congressional appropriations support the implementation of these authorities. In contrast, WS-Montana only addresses predator damage management upon request (Section 1.5 and WS Directive 2.201).

WS-Montana cannot use pesticides unless they are approved by the U.S. Environmental Protection Agency (EPA) per FIFRA and are registered for use in Montana. WS-Montana must ensure that all storage, use, and disposal by WS-Montana personnel are consistent with FIFRA label requirements and WS Directive 2.401.

APHIS-WS does not make wildlife management decisions. Each state has full authority and jurisdiction to manage the native wildlife within its boundaries, unless authority is granted to another governmental entity, such as the USFWS per the ESA, MBTA, or the Bald and Golden Eagle Protection Act (BGEPA).

In Montana, most native wildlife species are managed by MFWP per Montana Code Annotated (MCA) §87-1-201 and 87-5-105. The USFWS (Department of Interior) has authority over wildlife and plant species listed per the Endangered Species Act of 1973 (Public Law 93-205, 15 USC 1531 as amended). The State of Montana has its own Endangered Species Act (MCA §87-5-103 and 87-5-107), which is compiled from species native to Montana listed on the United States' list of endangered fish and wildlife. This list of endangered species can be found at ARM 12.5.201 and is a sublist of the USFWS list of endangered species in Montana

Invasive feral swine are managed by MDOL (MCA §81-29-103) as are coyotes, red fox, and any other individual animal causing depredations upon livestock (MCA §81-7-101).

Migratory birds are managed by the USFWS per the MBTA. The USFWS also manages waterfowl hunting and take of migratory birds, whether intentional or incidental to other activities pursuant with this law. Under some circumstances, permits from the USFWS are available for activities that would involve take of native migratory birds, which includes pursuing, hunting, taking, capturing, or killing migratory birds, or destroying any active nest or live egg.

The USFWS is also the authority for managing intentional and non-purposeful take of bald and golden eagles through the issuance of permits under the Bald and Golden Eagle Protection Act of 1940, as amended (BGEPA).

WS-Montana has no authority for determining the appropriate management of wildlife populations that are under the jurisdiction of MFWP and MDOL per their statutes, regulations, and species management plans and strategies, or management of species regulated in accordance with the ESA, the MBTA, or the BGEPA. Rather, WS-Montana responds to governmental and non-governmental requests for assistance in managing wildlife damage and threats.

For more details on the various federal and state laws regarding wildlife management and protection, see Section 2.4.4 and Appendix B.

1.7 What are the State of Montana's Authorities and Objectives for Managing Wildlife Damage?

It is APHIS-WS policy to comply with applicable state laws (APHIS-WS Directive 2.210) and APHIS-WS' practice to cooperate with states in managing wildlife damage. MFWP manages wildlife under its jurisdiction.

The mission of MFWP is to:

> "provide for the stewardship of the fish, wildlife, parks, and recreational resources of Montana, while contributing to the quality of life for present and future generations." (https://fwp.mt.gov/aboutfwp/our-vision).

Furthermore, one of MFWP's core values as listed in the Vision Guide (https://fwp.mt.gov/aboutfwp/our-vision) is to provide stewardship. MFWP's Vision and Guide 2016-2026 states, "We manage for healthy and abundant fish and wildlife populations, improve and protect habitat, and protect and restore cultural and historical resources."

MFWP has the following policies for managing wildlife per Montana Code Annotated 2017 (MCA) §87-1-102:

> (1) Except as provided in subsection (11), the department shall supervise all the wildlife, fish, game, game and nongame birds, waterfowl, and the game and fur-bearing animals of the state and may implement voluntary programs that encourage

hunting access on private lands and that promote harmonious relations between landowners and the hunting public. The department possesses all powers necessary to fulfill the duties prescribed by law and to bring actions in the proper courts of this state for the enforcement of the fish and game laws and the rules adopted by the department.

(2) Except as provided in subsection (11), the department shall enforce all the laws of the state regarding the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds within the state.

(3) The department has the exclusive power to spend for the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds all state funds collected or acquired for that purpose, whether arising from state appropriation, licenses, fines, gifts, or otherwise. Money collected or received from the sale of hunting and fishing licenses or permits, from the sale of seized game or hides, from fines or damages collected for violations of the fish and game laws, or from appropriations or received by the department from any other sources is under the control of the department and is available for appropriation to the department.

(4) The department may discharge any appointee or employee of the department for cause at any time.

(5) The department may dispose of all property owned by the state used for the protection, preservation, management, and propagation of fish, game, fur-bearing animals, and game and nongame birds that is of no further value or use to the state and shall turn over the proceeds from the sale to the state treasurer to be credited to the fish and game account in the state special revenue fund.

(6) The department may not issue permits to carry firearms within this state to anyone except regularly appointed officers or wardens.

(7) Except as provided in subsection (11), the department is authorized to make, promulgate, and enforce reasonable rules and regulations not inconsistent with the provisions of Title 87, chapter 2, that in its judgment will accomplish the purpose of chapter 2.

(8) The department is authorized to promulgate rules relative to tagging, possession, or transportation of bear within or outside of the state.

(9) (a) The department shall implement programs that:

(i) manage wildlife, fish, game, and nongame animals in a manner that prevents the need for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq.;

(ii) manage listed species, sensitive species, or a species that is a potential candidate for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq., in a manner that assists in the maintenance or recovery of those species;

(iii) manage elk, deer, and antelope populations based on habitat estimates determined as provided in 87-1-322 and maintain elk, deer, and antelope population numbers at or below population estimates as provided in 87-1-323. In implementing an elk management plan, the department shall, as necessary to achieve harvest and population objectives, request that land management agencies open public lands and public roads to public access during the big game hunting season.

(iv) in accordance with the forest management plan required by 87-1-622, address fire mitigation, pine beetle infestation, and wildlife habitat enhancement giving priority to forested lands in excess of 50 contiguous acres in any state park, fishing access site, or wildlife management area under the department's jurisdiction.

(b) In maintaining or recovering a listed species, a sensitive species, or a species that is a potential candidate for listing, the department shall seek, to the fullest extent possible, to balance maintenance or recovery of those species with the social and economic impacts of species maintenance or recovery.

(c) Any management plan developed by the department pursuant to this subsection (9) is subject to the requirements of Title 75, chapter 1, part 1.

(d) This subsection (9) does not affect the ownership or possession, as authorized under law, of a privately held listed species, a sensitive species, or a species that is a potential candidate for listing.

(10) The department shall publish an annual game count, estimating to the department's best ability the numbers of each species of game animal, as defined in 87-2-101, in the hunting districts and administrative regions of the state. In preparing the publication, the department may incorporate field observations, hunter reporting statistics, or any other suitable method of determining game numbers. The publication must include an explanation of the basis used in determining the game count.

(11) The department may not regulate the use or possession of firearms, firearm accessories, or ammunition, including the chemical elements of ammunition used for hunting. This does not prevent:

(a) the restriction of certain hunting seasons to the use of specified hunting arms, such as the establishment of special archery seasons;

(b) for human safety, the restriction of certain areas to the use of only specified hunting arms, including bows and arrows, traditional handguns, and muzzle loading rifles;

(c) the restriction of the use of shotguns for the hunting of deer and elk pursuant to 87-6-401(1)(f);

(d) the regulation of migratory game bird hunting pursuant to 87-3-403; or

(e) the restriction of the use of rifles for bird hunting pursuant to 87-6-401(1)(g) or (1)(h).

Further, MFWP has the following policies for managing nongame and endangered species per MCA §87-5-103:

(1) The legislature, mindful of its constitutional obligations under Article II, section 3, and Article IX of the Montana constitution, has enacted The Nongame and Endangered Species Conservation Act. It is the legislature's intent that the requirements of this part provide adequate remedies for the protection of the environmental life support system from degradation and provide adequate remedies to prevent unreasonable depletion and degradation of natural resources.

(2) The legislature finds and declares all of the following:

(a) that it is the policy of this state to manage certain nongame wildlife for human enjoyment, for scientific purposes, and to ensure their perpetuation as members of ecosystems;

(b) that species or subspecies of wildlife indigenous to this state that may be found to be endangered within the state should be protected in order to maintain and, to the extent possible, enhance their numbers;

(c) that the state should assist in the protection of species or subspecies of wildlife that are considered to be endangered elsewhere by prohibiting the taking, possession, transportation, exportation, processing, sale or offer for sale, or shipment within this state of species or subspecies of wildlife unless those actions will assist in preserving or propagating the species or subspecies.

Harvest regulations proposed by MFWP for fish, game, species in need of management, and furbearer species are subject to public review and input before being adopted by the MFWP Commission. Harvest regulations are designed to provide public recreational opportunity and reduce conflicts between wildlife and other land uses while ensuring perpetuation of healthy viable wildlife populations. MFWP is also authorized to cooperate with WS-Montana and MDOL for controlling predatory animals (MCA §87-1-201, §87-1-225).

The state provides two definitions of predatory animals. For the purposes of hunting regulations, "predatory animals" include coyote, weasel, skunk, and civet cat (MCA §87-2-101). Hunting of these species is not regulated; they can be shot in Montana year-round without a license by both resident and nonresident hunters. Coyotes, red fox, and "other animals causing depredation upon livestock" are also classified as predatory animals under MCA §81-7-101-102 and regulatory control of these animals to protect livestock is managed by MDOL. There are also no regulations restricting hunting of nongame species. "Nongame wildlife" means any wild mammal, bird, amphibian, reptile, fish, mollusk, crustacean, or other animal not otherwise legally classified by statute or regulation of this state (MCA §87-2-101). Examples of these species include raccoon, red fox, badgers, hares, marmots, tree squirrels, ground squirrels and prairie dogs.

MDOL is authorized to enter into agreements with WS-Montana and MFWP (MCA §81-7-102) for the control of predatory animals to provide for the "protection and safeguarding of livestock and poultry in this state against depredations from these animals." The term livestock is defined differently throughout the Montana Code Annotated. Included in these variations are cattle, sheep, swine, goats, horses, mules, asses, llamas, alpacas, bison, ostriches, rheas, emus, poultry, honey bees, alternative livestock as defined in §87-4-406, and domestic ungulates (MCA §15-1-101, §15-24-921, §81-2-702). MCA §87-3-127 further authorizes the use of dogs to pursue stock-killing black bears, mountain lions, and bobcats, and requires traps used to capture bears be inspected every 12 hours. Under MCA §81-7-103-104, MDOL is also authorized and directed to contribute monies "for the purpose of protecting livestock in the state against destruction, depredation, and injury by predatory animals, whether the livestock is on lands in private ownership, in the ownership of the state, or in the ownership of the United States, including open ranges and all lands of public domain." These authorizations and the Administrative Rules of Montana 32.22.101 through 32.22.106 form the basis for the cooperative relationship between MDOL and WS-Montana.

MDOL is also responsible for issuing aerial shooting permits per the Fish and Wildlife Act of 1956, as amended, and for administering an aerial program to reduce damage caused by predatory animals (MCA §81-7-501, §81-7-502, §81-7-505). An MOU between WS-Montana and MDOL establishes a cooperative relationship, outlines responsibilities, and sets forth annual objectives and goals of each agency for resolving predator damage in Montana. MDOL is further responsible for managing eradication of feral swine (MCA §81-29-102), and WS-Montana can survey and remove feral swine under the MOU between MDOL and WS-Montana.

To increase social tolerance for large predators, damage by grizzly bears, wolves, and mountain lions is compensated by the Montana Livestock Loss Board (MLLB) which was established by MCA §2-15-3110 to fulfill the compensation provisions of the Gray Wolf Management Plan (Montana Fish Wildlife and Parks 2003) and Grizzly Bear Management plans (Dood et al. 2006, Montana Fish Wildlife and Parks 2013) established in MCA §2-15-3111 through 2-15-3113. The program is based on the beliefs that both government and livestock producers want to take reasonable and cost-effective measures to reduce losses, and that livestock owners should not incur disproportionate impacts as a result of the recovery of Montana's wolf and grizzly populations. The source of funding for compensation payments in recent years has been primarily the state general fund (MCA §81-1-110). As a state operated program, the MLLB has a trust fund that can be funded with tax deductible gifts, grants, appropriations, or allocations from any source per Internal Revenue Service section 170(c)(1). This is similar to a 501(c) (3) private nonprofit organization. Livestock covered by this program are cattle, swine, horses, mules, sheep, goats, llamas, and livestock guarding animals. The MLLB is authorized, by MCA §81-1-113 to use half the money transferred into the Livestock Loss Reduction and Mitigation Restricted Account (MCA §81-1-112) pursuant to subsection (2) to contract with APHIS-WS. The MLLB is an independent board administratively attached to the MDOL.

Montana Department of Agriculture (MDA) manages the pesticide laws in Montana that regulate use of sodium cyanide, DRC-1339, and gas cartridges which may be used to reduce conflicts with select predators. WS-Montana registers these chemicals with MDA, and all WS-Montana restricted use pesticide users become certified pesticide applicators through MDA. MDA conducts random and unannounced inspections on WS-Montana pesticide applicators. In Indian Country, Tribal Inspectors conduct inspections on WS-Montana pesticide applicators.

Free-ranging and feral dogs can be threats to human health and safety, agriculture, natural resources, and property (Bergman et al. 2009). Under Montana state law (MCA §81-7-401) dogs may be killed by the livestock owner, their agent/employee, or the dog owner if the dog is caught in the act of killing, injuring, or harassing livestock. MCA §81-7-402 states that any owner of a dog found in the act of killing or injuring livestock is liable for damages to the livestock. In Montana, control of free-ranging dogs and cats is generally the responsibility of local governmental agencies, county or municipal animal control officials, or county sheriffs. WS-Montana policy allows WS-Montana personnel to assist in feral and free-ranging dog or cat control at the request of local authorities upon approval of the WS-Montana State Director.

APHIS-WS Directive 2.340 regarding responding to damage caused by feral, free-ranging, and hybrid dogs states that such actions will be coordinated either for each project or programmatically with state, local and tribal authorities before taking action, and that each state will develop a state-level policy. WS-Montana's policy is to:

> "Only conduct dog damage management when requested in writing from the municipal, county, tribal, or state government entity with jurisdiction over dogs. The written request must be received by the State Director. That request must identify the need and the status of the dogs (feral, free-ranging, hybrid). Such work by WS-Montana must be in coordination with the municipal, county, tribal, or state agency with jurisdiction over management of dogs throughout the operation after having gained concurrence from such entity. In non-urban areas, WS-Montana personnel may conduct feral, free-ranging, and hybrid dog damage management to protect agriculture and animal husbandry, natural resources, and human health and safety. In urban areas, WS-Montana may conduct feral, free-ranging, or hybrid dog damage management for the protection of human health and safety. On airports/airfields, WS-Montana may conduct feral, free-ranging, or hybrid dog damage management for the protection of human health and safety in urban or non-urban areas."

Per the APHIS-WS Directive, the field employee capturing any free-ranging dog that is determined to be a pet they shall inform the owner, if possible, as soon as is practical. WS-Montana is infrequently called to respond to feral or free-roaming dog complaints (less than 1% of all responses of the species in this EA), as these are usually handled by local officials.

MFWP also has developed numerous management plans for managed species in Montana. MFWP has management and/or conservation plans for management of:

- Gray wolf (Montana Fish Wildlife and Parks 2003)

- Mountain lion (Montana Fish Wildlife and Parks 2019b)
- Grizzly bear (Dood et al. 2006, Montana Fish Wildlife and Parks 2013)
- Black bear (Mace and Chilton-Radant 2011)

Portions of these plans as appropriate are integrated into this EA as needed to support needs and analyses within the context of appropriate state policies.

1.8 How Does WS-Montana Work with Federal, State, and County Agencies?

1.8.1 How Does WS-Montana Work with MFWP, MDOL, MLLB, and Counties?

When assistance is requested from MFWP, MDOL, or MLLB for a predator damage-related problem that involves a state agency, WS-Montana cooperates with the state agency per applicable Montana statutes and regulations, and in accordance with guidelines, restrictions, and objectives set forth by these MFWP management and conservation plans and cooperative service agreements. WS-Montana can act as an agent for MFWP, MDOL, MLLB, or a landowner, depending on the entity requesting assistance.

The MFWP, MDOL, MLLB, counties, tribes, associations, and private entities form the basis of cooperative WS-Montana IPDM work activities. The MFWP, MDOL, MLLB, and counties are authorized by MCA §81-7-102-104, §81-7-501-502, and §87-1-201 to allocate funds to mutually cooperate with WS-Montana for wildlife damage control of predatory animals. MDOL and MFWP sometimes request assistance with monitoring and control of livestock diseases that have a wildlife component.

WS-Montana has Cooperative Service Agreements, Annual Work Plans, and MOUs with MFWP and MDOL and a Cooperative Service Agreement and an Annual Work Plan with MLLB. These documents establish a cooperative relationship between WS-Montana and MFWP, MDOL, and MLLB, outline responsibilities and agreements for funding, and set forth objectives and goals for resolving wildlife damage conflicts in Montana. Recognizing that the wording of these agreements may change upon renewal, it is not expected that future conditions included in the agreements would have environmental relevance not already evaluated in this EA.

Under the MOU, Cooperative Service Agreement, and Annual Work Plan with MFWP, WS-Montana provides professional assistance upon request to resolve wildlife and human conflicts related to certain wildlife damage to agriculture, horticulture, animal husbandry, forest and range resources, and public health and safety caused by black bears, mountain lions, grizzly bears, and wolves. MFWP, as the lead agency, may request assistance from WS-Montana for any species under their primary responsibility, with WS-Montana acting as their agent for PDM work. While WS-Montana is acting as an agent for MFWP for PDM work under state agency jurisdiction, MFWP is the lead agency at all times. MFWP is responsible for issuing any required permits for management actions.

The Cooperative Service Agreement and MOU with MDOL assigns responsibility to APHS-WS for providing supervision of the cooperative aerial predator damage management program that ensures work is conducted in accordance with the latest wildlife damage management practices. DOL provides two helicopters for use in the aerial program, and WS-Montana oversees the day to day operation and maintenance. Further, state law provides for cooperation between MDOL and WS-Montana (§81-7-102, §81-7-501, and §81-29-102), and MDOL provides funds to WS-Montana for the control of predatory animals (MCA §81-7-102-104 and §81-7-501-502). Therefore, WS-Montana can operate under federal authority as well as the authority of state law to work directly for cooperators.

The Cooperative Service Agreement with MLLB provides funds and authority to WS-Montana to implement a non-lethal program for the management of damage to livestock in Montana caused by gray wolves, grizzly bears, and mountain lions. The non-lethal program may include, but is not limited to, depredation investigations and necropsies, writing of investigative reports, capture and chemical immobilization, transfer of custody, radio-collaring, surveillance, monitoring, and implementation of non-lethal methods to reduce livestock predation caused by gray wolves, grizzly bears, and mountain lions. The MLLB provides funds to WS-Montana as authorized by MCA §81-1-112 to implement this program.

At other times, when not working as an agent for MFWP, MDOL, or MLLB, WS-Montana has authority under the Animal Damage Control Act of 1931 and subsequent amendments allowing for WS-Montana to enter into agreements with public and private entities. Additionally, MCA §81-7-505. §87-6-106, §87-3-127, and §81-29-102 allow property owners or their agents to address predators and/or damage caused by wildlife on their property. [While MCA §87-6-106 will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (see below and 40 CFR 31734, July 28, 1975) supersede this state law.] WS-Montana therefore may either act as an agent for MFWP, MDOL, MLLB, or may directly act for requesting land/resource owners to address wildlife damage conflicts under legislative authority and state law.

The pertinent components of current WS-Montana MOUs and Cooperative Service Agreements with MFWP, MDOL, and MLLB include:

A. MFWP/WS-Montana MOU for Grizzly Bears, Gray Wolves, Black Bears, and Mountain Lion Damage Management

An MOU has been established for the management of grizzly bears, gray wolf, black bears, and mountain lion damage management. Below are important excerpts:

- "Both parties will cooperate by providing facilities, equipment, personnel, and funds to conduct a joint program in the State of Montana, which will prevent or minimize the economic effects of depredations caused by wildlife and contribute to conservation of native wildlife."
- "WS will be responsible for responding to livestock depredation complaints involving grizzly bears, wolves, black bears, and mountain lions. All livestock depredation complaints will be referred to WS. If requested by WS, and if time and financial resources are available, FWP will assist WS."
- "FWP will be responsible for responding to non-livestock complaints involving grizzly bears, wolves, black bears, and mountain lions. All non-livestock complaints will be referred to FWP. If requested by FWP, and if time and financial resources are available, WS will assist FWP."

- "WS will apply an Integrated Wildlife Damage Management (IWDM) approach to resolving conflicts. IWDM includes the integration and application of all practical methods of prevention and control to minimize wildlife damage. Providing a responsive and effective program that is scientifically sound and socially acceptable promotes tolerance and avoids the likelihood of untrained and unqualified public from attempting solutions on their own, which may be detrimental to wildlife, the environment, and people."

The entire MOU is available by contacting the WS State Director's Office, P.O. Box 1938, Billings, MT 59101

B. MFWP/WS-Montana Cooperative Service Agreement for Predatory Animal Damage Control

WS-Montana also has a Cooperative Service Agreement with MFWP that provides for mutual consultations, development of Annual Work Plans, compliance with NEPA and other laws, and payment of services for wildlife damage management actions taken at the request of MFWP.

The resulting Annual Work Plan typically includes the following goals and objectives:

- To confer and plan a WDM program that addresses the need for managing predatory species.
- As a federal agency, WS-Montana must determine that compliance with NEPA, ESA, and other applicable federal environmental statutes are completed before undertaking any wildlife damage management actions.
- Objectives/Goals: 1) To facilitate wildlife animal damage management in Montana by APHIS-WS to help achieve wildlife management objectives of MFWP; 2) To manage wolves consistent with MCA §81-1-217 and the Montana Wolf Management Plan to sustain the wolf population and integrate wolves into overall wildlife management programs in Montana; and 3)To focus management actions on capture, monitoring, and incremental control of wolves, as well as proactive preventative actions to help reduce or minimize potential for wolf predation on livestock.
- WS-Montana will use field personnel to respond to requests for assistance in controlling and destroying predatory animals that are or may be destructive to agricultural crops, products and activities, but excluding game birds and other birds determined by the MFWP to be in need of protection.
- Methods used by WS-Montana may include lethal and non-lethal methods with trap check times recommended by MFWP or state regulations for predatory animals.

C. MDOL/WS-Montana Cooperative Service Agreement for IWDM Actions

WS-Montana has a Cooperative Service Agreement with MDOL that provides for mutual consultations, development of annual work plans, compliance with NEPA and other laws, and payment of services for wildlife damage management actions taken at the request of MDOL.

The resultant Work Plan typically includes the following goals and objectives:

- WS-Montana will provide supervision of direct assistance programs to facilitate control of damage to livestock in Montana caused by predatory wild animals. WS-Montana will ensure work is conducted in accordance with the latest wildlife damage management practices and is congruent with bird and mammal management programs.
- Objectives/Goals: To utilize two turbine helicopters owned by DOL to provide aerial operations to Montana livestock producers and others requesting management of predatory animals to protect livestock from predation by wildlife.

D. MDOL/WS-Montana MOU for Aerial Operations in Montana

- Both parties will develop annually a plan for aircraft usage and an estimate of costs for aircraft repairs, maintenance and engine replacement/rebuilds.
- Objectives/Goals: 1) To carry out aerial operations in Montana; and 2) to facilitate the cooperative aerial predator damage management program between the MDOL and WS-Montana through the use and management of two helicopters owned by MDOL and used by WS-Montana to provide services to Montana livestock producers and other requesting assistance in controlling damage caused by predatory animals.

This MOU is available by contacting the WS State Director's Office, P.O. Box 1938, Billings, MT 59101.

E. MDOL/WS-Montana Cooperative Service Agreement for the Utilization of the State Voluntary Wolf Management Account

WS-Montana also has a Cooperative Service Agreement with MDOL that provides guidelines for the use of funds from the voluntary wolf management account in the special state revenue fund established in MCA §17-2-102 for wolf damage management. Funds may be used for salaries, benefits, travel, and other expenses as necessary for WS-Montana to perform the Agreement activities. All equipment and supplies purchased under the terms of this agreement will remain the property of WS-Montana.

The resultant Work Plan typically includes the following goals and objectives:

- To utilize funding from the state voluntary wolf management account pursuant to MCA §87-2-202 to manage wolves in a manner consistent with MCA §87-1-217 and the Montana Wolf Management Plan to sustain the wolf population and integrate wolves into overall wildlife management plans in Montana.
- WS-Montana will provide an annual report on the use of funds, including but not limited to flight time, collaring, and lethal control of wolves.

F. MLLB/WS-Montana Cooperative Service Agreement for Gray Wolf, Grizzly Bear, and Mountain Lion Damage Management

WS-Montana has a Cooperative Service Agreement with MLLB that provides for mutual consultations, development of annual work plans, compliance with NEPA and other laws, and payment of services for wildlife damage management actions taken at the request of MLLB.

The Cooperative Service Agreement assigns responsibility to WS-Montana for supervision of depredation investigations and necropsies, writing of investigative reports, capture and chemical immobilization, transfer of custody, radio-collaring, surveillance, monitoring, and implementation of non-lethal methods to manage damage to livestock in Montana by gray wolves, grizzly bears, and mountain lions.

The resultant Work Plan typically includes the following goals and objectives:

- Objectives/Goals: 1) To insure that WS-Montana provides supervision of nonlethal programs operations to insure work is conducted in accordance with the latest WDM practices and is congruent with wolf and grizzly bear management programs to reduce livestock predation caused by these species; and 2) to enhance gray wolf and grizzly bear damage management work conducted by WS-Montana to reduce predation on livestock by these two species.

Any state agencies not currently under an MOU or Cooperative Service Agreement with WS-Montana may enter into one consistent with the analyses and impacts in this EA and APHIS-WS policies and directives, and thereby the activities would be covered by this EA.

1.8.2 How Does WS-Montana Work with Federal Agencies and Tribes?

1.8.2.1 How Does WS-Montana Work with the U.S. Forest Service and the BLM?

The USFS and the BLM manage federal lands under their jurisdiction for multiple uses, including wildlife habitat, livestock grazing, timber, wilderness, cultural resources, and recreation.

APHIS-WS coordinates with these land management agencies before performing IPDM activities on lands under their jurisdiction through Annual Work Plans (AWPs) (See Section 3.11). The federal land management agencies USFS and BLM prepare land management plans per the National Forest Management Act (USFS) and Federal Land Policy and Management Act (FLPMA; BLM) that guide long-range management direction and include action constraints for protecting sensitive resources. At some time either during or prior to the last five years, WS-Montana has been requested by grazing permittees or state wildlife agencies to operate on most National Forests and BLM Districts. Current work plans involve 7 national forests in Montana and 3 BLM districts for protection of livestock and human safety. All national forests and BLM Districts may request WS-Montana assistance with emergency work at any time.

For this EA, the USFS and BLM are consulting agencies and have been involved with this EA to ensure consistency with their land management plans. WS-Montana currently has AWPs with the following forests:

- Beaverhead-Deerlodge NF
- Bitterroot NF

- Custer- Gallatin NF
- Flathead NF
- Helena-Lewis and Clark NF
- Kootenai NF
- Lolo NF

BLM has 3 districts, each with several field offices. WS-Montana currently has AWPs with the following districts:

- Western Montana District
- North Central Montana District
- Eastern Montana Dakotas District

For WS-Montana, over the five years analyzed, less than 6.5% of take of target predators and 4.5% of responses to conflicts with predator species occur on Federally managed public land (MIS 2017).

1.8.2.2 What MOUs Does APHIS-WS Have with the U.S. Forest Service and BLM?

APHIS-WS has memoranda of understanding (MOUs) with the USFS and the BLM for PDM work on federal lands and resources under their jurisdiction. These MOUs are available by contacting the WS State Director's Office, P.O. Box 1938, Billings, MT 59101.

A. MOU with the Forest Service:

- Documents the cooperation between the USFS and APHIS-WS for managing indigenous and feral vertebrates causing resource damage on National Forest System lands; minimizing livestock losses due to predation by coyotes, mountain lions, and other predators; managing wildlife diseases; managing invasive species; and protecting other wildlife, plants, and habitat from damage as requested by the Forest Service and/or state or federal wildlife management agencies.
- APHIS-WS evaluates needs for IPDM in cooperation with the USFS, and develops and annually updates Annual Work Plans (AWPs) in cooperation with the USFS and appropriate state and federal agencies, tribes, and others. USFS cooperates with APHIS-WS to ensure that planned IPDM activities do not conflict with other land uses, including human safety zones, and to ensure that work plans are consistent with forest plans. APHIS-WS notifies the USFS before conducting activities on National Forest System lands and provides reporting on IPDM results.
- APHIS-WS is responsible for NEPA compliance for wildlife damage management, invasive species management, and wildlife disease management activities initiated by APHIS-WS. APHIS-WS coordinates with the USFS, relevant state and federal agencies, and tribes in completing the NEPA process for such activities.
- APHIS-WS provides technical assistance and training to the USFS on IWDM methodologies when requested.

B. MOU with the BLM:

- Documents cooperation with BLM, APHIS-WS, and state governments, provides guidelines for field operations, and identifies responsibility for NEPA compliance for PDM activities regarding predation by native and feral animals on livestock and wildlife, including federally-listed threatened and endangered species, and to other resources and human health and safety, consistent with multiple-use values.

- APHIS-WS and BLM cooperate to identify areas on BLM lands where mitigation or restrictions may apply, including human health and safety zones; the development and annual review of PDM plans on BLM resources, consistent with the Federal Land Policy and Management Act, land and resource management plans, and federal laws; and evaluate needs for PDM in cooperation with state agencies, grazing permittees, adjacent landowners, and any other resource owner or manager, as appropriate.
- APHIS-WS is responsible for NEPA compliance for predator and invasive species damage and wildlife disease management activities conducted in response to requests on BLM lands, and will coordinate with and report to the BLM and state and local agencies and tribes during compliance.
- APHIS-WS will notify the BLM about the results of actions taken on BLM lands in an annual report.
- BLM is responsible for conducting minimum requirements analyses to measure impacts of PDM activities in wilderness areas and wilderness study areas.
- WS and BLM will follow stipulations in any subsequent versions of the WS-BLM MOU.

In addition to these MOUs, the USFS, BLM, and the Association of Fish and Wildlife Agencies entered into an agreement in June 2006 entitled “Policies and Guidelines for Fish and Wildlife Management in National Forest and Bureau of Land Management Wilderness” (Association of Fish and Wildlife Agencies 2006d). These policies and guidelines provide the framework for cooperation for fish and wildlife management in federal wilderness areas, respective of the agency jurisdiction as authorized by the Wilderness Act (Sec. 4(d)(8)) that provides authority for states to manage fish and wildlife in the national forests. This agreement addresses the restrictions on certain actions in wilderness areas, such as use of motorized equipment and pesticide use, with specific exceptions. The Policies and Guidelines specifically address wildlife damage control in Section 13. The three agencies agreed to use the Minimum Requirements Decision Guide Process Outline to determine if the action is necessary to manage the area as wilderness (including when continued livestock grazing is allowed according to the wilderness designation legislation) and, if so, to determine the minimum tool to address the need (see Section 1.10.4 for Wilderness Act).

The BLM incorporated the Policies and Guidelines agreement into affected BLM manuals (Bureau of Land Management 2004;2012b;a) and handbooks on 2/5/2007, updated 10/21/2009. The USFS incorporated the Policies and Guidelines into FSM

2323.32 and FSH 2309.19 to be implemented "in a practical, reasonable, and uniform manner in all National Forest wilderness units" (U.S. Forest Service 2007)

PDM actions in Wilderness Areas and Wilderness Study Areas are discussed further in Section 3.11.

1.8.2.3 How does WS-Montana Work with Federal Agencies to Review Proposed Work in Wilderness Areas and Wilderness Study Areas?

For non-emergency WS-Montana activities proposed in WAs and WSAs, WS-Montana would present the proposed activities for the year to the BLM and USFS during their respective annual work plan meetings. For PDM activities proposed in designated USFS-managed wilderness, approval by the Regional Forester is required on a case-by-case basis. A minimum requirements analysis (MRA) would be necessary, using the Minimum Requirements Decision Guide. Work proposed in wilderness study areas managed by either agency would be included in the annual work plan process. The agencies will determine if the proposed activities have adequate NEPA prior to approving those projects in wilderness study areas.

If additional NEPA is deemed necessary, the analysis provided in this EA may be used to inform that decision-making process. The BLM or USFS may adopt the WS-Montana analysis conducted through this NEPA process programmatically and/or through a site specific annual NEPA decision to approve or deny the annual proposed activities of WS-Montana. If there is sufficient NEPA in place that adequately analyzed the work proposed in the annual work plan and Minimum Requirements Decision Guide, BLM or USFS may issue a Determination of NEPA Adequacy for the year's plans.

PDM actions in Wilderness Areas and Wilderness Study Areas are discussed further in Section 3.11.

1.8.2.4 How Does WS-Montana Work with the U.S. Fish and Wildlife Service?

When IWDM activities may affect federally listed threatened or endangered species, WS-Montana consults with the U.S. Fish and Wildlife Service (USFWS) to ensure its program will not jeopardize the continued existence of the listed species. Under Section 7 of the ESA, federal agencies must consult with the USFWS when any action the agency carries out, funds, or authorizes may affect a listed endangered or threatened species. Effects of WS-Montana activities on federally listed species in Montana were evaluated by the USFWS in Biological Opinions for impacts on listed Canada lynx (July 24, 2009) and grizzly bears (June 8, 2012). WS-Montana determined that PDM activities will have No Effect on all other listed species (whooping crane, piping plover, interior least tern, yellow-billed cuckoo, red knot, black-footed ferret, northern long-eared bat, pallid sturgeon, white sturgeon, bull trout, water howellia, Spalding's catchfly, Ute ladies' tresses, western glacier stonefly, and meltwater lednian stonefly; dated April 27, 2015 and February 21, 2020). WS-Montana closely follows operational measures outlined in its ESA consultation documents to minimize the risk of take of listed species (Section 2.4).

WS-Montana may also assist the USFWS in protecting ESA-listed species, when requested. As of 2020 WS-Montana has an annual Interagency Agreement with USFWS providing $250,000 for the management of human-grizzly bear conflicts in Montana.

Minimization measures, reasonable and prudent measures, and terms and conditions included in the consultation documents are identified in Section 2.4 and analyses of the potential impacts of the WS-Montana program on threatened and endangered species is located in Section 3.6.

APHIS-WS has a national Memorandum of Understanding with the USFWS, including the following pertinent sections:

- APHIS-WS and the USFWS recognize that non-target migratory birds might incidentally be killed despite the implementation of all reasonable measures to minimize the likelihood of take during actions covered under depredation permits, depredation and control orders, and agricultural control and eradication actions.
- During NEPA compliance, APHIS-WS will evaluate the reasonable range of alternatives, assess and estimate impacts on migratory birds, monitor migratory birds with other collaborators (as funds allow), and consider impacts on target and non-target species and ways to minimize impacts.
- USFWS will provide APHIS-WS available migratory bird population data, reported take by non-APHIS-WS entities, and biological information as requested within a reasonable time frame.

1.8.2.5 How Does WS-Montana Work with the Federal Aviation Administration and National Association of State Aviation Officials?

WS-Montana works with the Federal Aviation Administration (FAA) and National Association of State Aviation Officials (NASAO), when requested, for necessary resolution of wildlife damage manage at airports to support aviation safety.

APHIS-WS MOU with the FAA and the NASAO:

- This partnership supports the organizations' common mission to collaboratively advance and encourage aviation safety within their respective areas of responsibility and to reduce wildlife hazard risks through education, research, and outreach, including promoting effective communication for ensuring critical safety, security, efficiency and natural resources/environmental compatibility.
- The end goal is to increase wildlife strike reporting and technical and operational assistance and necessary training to the aviation community to ultimately reduce the risk of wildlife hazards and ensure safer operations at airports.

1.8.2.6 How Does WS-Montana Work with Tribes?

WS-Montana recognizes the rights of sovereign tribal nations, the unique legal relationship between each Tribe and the Federal Government, and the importance of strong partnerships with Native American communities. WS-Montana is committed to respecting tribal heritage and cultural values when planning and initiating wildlife damage management programs as requested by Tribal governments and/or residents or permittees. Timely and meaningful consultation and coordination with tribal governments, to the greatest extent practicable and permitted by law, are conducted consistent with Executive Order (EO) 13175 and APHIS-WS' plan implementing the EO, including implementing the government-to-government relationship. WS-Montana offers early opportunities for formal government-to-government consultation on its proposed program to all Tribes in Montana, and has requested their involvement for this EA through direct invitations (March and November 2014) and agency draft EA review opportunities (August and October 2020).

The APHIS Native American Working Group, created in response to EO 13175 and made up of management and support program personnel, advises APHIS-WS personnel nationwide how they can better serve Tribes, Intertribal committees, and related organizations, and helps coordinate APHIS partnerships with Tribal governments. The APHIS-WS Tribal Liaison contact information is found at https://www.aphis.usda.gov/aphis/ourfocus/tribalrelations/sa_tribal_contact_us.

WS Directive 1040.3, "Consultation with Elected Leaders of Federally Recognized Indian Tribes" (https://www.aphis.usda.gov/library/directives/pdf/1040_3.pdf) implements EO 13175 (Section 2.4.1.16). It directs APHIS-WS agencies to provide federally recognized tribes the opportunity for government-to-government consultation and coordination in policy development and program activities that may have direct and substantial effects on their Tribe. Its purpose is to ensure that tribal perspectives on the social, cultural, economic, and ecological aspects of agriculture, as well as tribal food and natural resource priorities and goals, are heard and fully considered in the decision making processes of all parts of the Federal government. The Directive provides detailed definitions relevant to APHIS-WS and tribal government interactions and relationships, laws, and regulations, policy, and APHIS-WS management responsibilities. Regarding interpretation of agency or Tribal policies, the Directive states: "Unless specific judicial rulings or Acts of Congress indicate otherwise, APHIS' policy and philosophy will not be construed as validating the authority of any Native American government over lands or other resources or non-tribal members."

No WS-Montana IPDM activities are conducted on tribal lands without a specific request from the tribe. WS-Montana currently has MOUs with the Blackfeet Nation and the Confederated Salish and Kootenai (CSKT), Crow, Fort Peck, and Fort Belknap Tribe and could conduct IPDM on tribal lands according to these established agreements. These MOUs authorize WS-Montana to investigate livestock depredation complaints and outline steps to coordinate with the tribes in the event that IPDM actions take place. If a livestock producer operating on Indian Lands requests WS-Montana assistance, WS-Montana will consult with the tribe regarding when, where, and how IPDM actions and strategies may be conducted, and ensure that the action and strategy is approved and follows all state and tribal laws. If IPDM activities are requested on Indian Lands, the Tribal government and/or the Bureau of Indian Affairs have the authority to determine the methodology used. At the tribe's request, WS-Montana will report on any IPDM activities taken on tribal lands, including lands within the reservation boundary but not currently owned by or managed by or for the tribe.

Federal agencies have trust responsibilities to federally-recognized tribes that other entities and governments do not, including government-to-government relationship, consultation, and coordination. IPDM actions taken by non-Federal entities may not provide the participation in decision making regarding IPDM activities that is provided by APHIS-WS as a federal agency.

The Native American Graves and Repatriation Act of 1990 (NAGPRA), and Senate Bill 61 (signed in 1992), requires, in part, that a federal agency that makes new and inadvertent discoveries of Native American cultural items, including human remains, funerary objects, sacred objects, and other objects possessing continuing cultural, traditional, or historical importance to tribes and Native Americans during its actions on federal, state or private lands shall notify tribes and return such items to lineal descendants or Indian Tribes associated with such items. Since WS-Montana does not cause ground-disturbance during its IPDM activities, it is highly unlikely that any such items would be disturbed during activities. However, some items may be on or near the surface and be found by WS-Montana field personnel, at which time work would stop in that area and NAGPRA processes would be implemented.

1.9 How Does WS-Montana Comply with NEPA?

1.9.1 How Does NEPA Apply to WS-Montana's IPDM Activities?

WS-Montana predator damage management activities are subject to the National Environmental Policy Act of 1969 (NEPA) (Public Law 9-190, 42 U.S.C. 4321 et seq.). The APHIS-WS program follows the Council on Environmental Quality (CEQ) regulations implementing the NEPA (40 CFR 1500 et seq.) along with USDA (7 CFR 1b) and APHIS Implementing Procedures (7 CFR 372) as part of the decision-making process. For this EA, WS will proceed under the 1978 NEPA regulations and existing APHIS procedures because this EA was initiated prior to the September 14, 2020 NEPA revisions. NEPA sets forth the requirement that all federal actions be evaluated in terms of:

- Their potential to significantly affect the quality of the human environment for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts;
- Making informed decisions; and
- Including agencies and the public in their NEPA planning in support of informed decision-making.

Updates regarding WS-Montana implementation of predator damage management in Montana have prompted WS-Montana to initiate this new analysis. The analyses contained in this environmental assessment (EA) are based on information and data derived from APHIS-WS' Management Information System (MIS) database; data from the MDOL, MLLB, and MFWP regarding species under their jurisdiction; published and, when available, peer-reviewed scientific documents (Chapter 4); interagency consultations; public involvement; and other relevant sources.

This EA describes the needs for resolving the types of predator damage WS-Montana is typically requested to assist with. The EA identifies the potential issues associated with reasonable alternative methods and levels of assistance. It then evaluates the environmental consequences of the alternatives for WS-Montana involvement in IPDM.

To assist with understanding applicable issues and reasonable alternatives to managing predator damage in Montana and to ensure that the analysis is complete for informed decision-making, WS-Montana has made this EA available to the public, agencies, tribes and other interested or affected entities for review and comment prior to making and publishing the decision (either preparation of a Finding of No Significant Impact (FONSI) or a Notice of Intent to prepare an Environmental Impact Statement (EIS)). Public outreach notification methods for an EA include postings on the national APHIS-WS NEPA webpage and on www.regulations.gov, a direct mailing to known local stakeholders, electronic notification to registered stakeholders on www.GovDelivery.com, and notification in the legal section of the *Helena Independent Record* newspaper. The public will be informed of the decision using the same venues, including direct mailed notices to all individuals who submit comments and provide physical addresses.

Wildlife damage management is a complex issue requiring coordination among state and federal agencies and the tribes. To facilitate planning, efficiently use agency expertise, and promote interagency coordination with meeting the needs for action (Section 1.11), WS-Montana is coordinating the preparation of this EA with cooperating and consulting partner agencies, including MFWP, MDOL, USFS, BLM, USFWS, the Blackfeet Nation, the Confederated Salish and Kootenai (CSKT), Northern Cheyenne, Chippewa-Cree, Crow, Fort Peck, and Fort Belknap Tribes. WS-Montana also recognizes the sovereign rights of Native American tribes to manage wildlife on tribal properties, and has invited all federally recognized cooperating tribes in Montana to cooperate or participate in the development of this EA. The WS-Montana program is committed to coordinating with all applicable land and resource management agencies including tribes when IPDM activities are requested.

1.9.2 How will this EA Be Used to Inform WS-Montana's Decisions?

WS-Montana only conducts predator damage management activities when requested by a governmental, commercial, or private entity and as a federal agency is required to comply with NEPA regulations. WS-Montana is the lead for the APHIS-WS IPDM program in Montana. WS-Montana has the technical expertise in management of damage caused by native predators. Cooperating Agencies in the development of this EA are MFWP and MDOL, consulting agencies are BLM, USFS, the Blackfeet Nation, the Confederated Salish and Kootenai (CSKT), Northern Cheyenne, Chippewa-Cree, Crow, Fort Peck, and Fort Belknap Tribes.

Each of the cooperating and consulting agencies are asked to review the draft document and provide input and direction to WS-Montana to ensure that actions are in compliance with applicable federal and state regulations and policies, as well as current federal land management plans and joint MOUs, and Cooperative Service Agreements.

WS-Montana will use the analyses in this EA to help inform WS-Montana decision-making, including whether to prepare an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI); and whether or not to continue WS-Montana

IPDM activities and, if so, to determine how and to what degree such activities would be implemented.

WS-Montana previously prepared EAs for its predator damage management program in two districts in Montana:

- 1997 EA and Decision/FONSI for Predator Damage Management in eastern Montana
- 1997 EA and Decision/FONSI for Predator Damage Management in western Montana

In addition, WS-Montana previously prepared a 2013 EA and Decision/FONSI for Wolf Damage Management in Montana. Wolves in Montana were congressionally delisted in 2011 and have since remained under MFWP management authority. They are now managed in a manner similar to other large predator species in Montana with hunting and trapping seasons, private landowner take under Senate Bill 200, and additional management removal by WS-Montana after livestock depredations are confirmed. For these reasons, this EA includes wolves as an analyzed species.

WS-Montana has decided that one EA analyzing potential operational impacts for the entire State of Montana provides a more comprehensive, and less redundant analysis than multiple EAs covering smaller regions. APHIS-WS has also determined that the management of wildlife in the various states, including state laws and regulations, is different enough as to warrant separate NEPA analyses for each state. In addition, most state-resident wildlife species are managed under state authority or law, without any federal oversight or protection. Therefore, this EA is limited to the State of Montana. This approach also provides a broader scope for the effective analysis of potential cumulative impacts and for using data and reports from state and federal wildlife management agencies.

On September 12, 2016, WS released a pre-decisional EA for public review on www.Regulations.gov (Docket No. APHIS-2016-0064). The public was asked to provide comments by October 14, 2016. WS neither issued a final EA nor a decision document from that draft EA. WS decided to begin the NEPA process anew and is issuing this draft EA for public comment. WS did not carry over the comments submitted on the September 2016 draft EA to this new EA.

Upon public notification of the signed decision for the appropriate NEPA document for WS-Montana IPDM activities, the previously listed EAs (2 regional EAs and 1 wolf damage management EA) and FONSIs will be superseded and replaced.

1.9.3 How Does this EA Relate to Site-Specific Analyses and Decisions, Using the APHIS-WS Decision Model?

Many of the species addressed in this EA can be found statewide within suitable habitat, and damage or threats of damage can occur wherever those species occur and overlap with human presence, resources, or activities. Wildlife damage management falls within the category of actions in which the exact timing or location of individual requests for assistance can be difficult to predict with sufficient notice to accurately describe the locations or times in which WS-Montana can reasonably expect to be acting. Although

WS-Montana could predict some of the possible locations or types of situations and sites where some kinds of predator-related damage could occur, the program cannot predict the specific locations or times at which affected resource owners would determine that a damage problem has become intolerable to the point that they request assistance from WS-Montana. Therefore, WS-Montana must be ready to provide assistance on short notice anywhere in Montana to protect any resource or human/pet health or safety upon request.

The Decision Model is the site-specific procedure for individual actions conducted by WS-Montana personnel in the field when they respond to requests for assistance. Site-specific decisions made using the model are in accordance with NEPA decisions and include applicable Decision Model, relevant laws and regulations, interagency agreements and memoranda of understanding, and cooperating agency policy and procedures.

The analyses in this EA are intended to apply to any action that may occur in any locale and at any time within Montana for which WS-Montana may be requested for assistance. Using the WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for field operations, this EA meets the intent of NEPA with regard to site-specific analysis, informed decision-making, and providing the necessary timely assistance to agencies and cooperators per WS-Montana objectives.

1.9.4 What is the Geographic Scope of this EA and in What Areas Would WS-Montana Actions Occur?

The geographic scope of the actions and analyses in this EA is statewide. WS-Montana has decided that one EA analyzing potential operational impacts for the entire State of Montana provides a more comprehensive and less redundant analysis than multiple EAs covering smaller regions. This approach also provides a broader scope for the effective analysis of potential cumulative impacts and for using data and reports from state and federal wildlife management agencies, which are typically on a state-wide basis.

Areas in which WS-Montana IPDM activities occur encompass rural and urban areas, including residential and commercial development, rangelands, pastures, ranches and farms, agricultural croplands, timber and forested areas, recreation areas and trails, airports, wildernesses and wilderness study areas where authorized and requested, and other places where predators may overlap with human occurrence, activities, and land uses and create conflicts. The proportion of IPDM operations conducted on various land classes is found in Table 1.3.

Routinely, operational areas may include:

A. Private Property

Private and commercial property owners and/or managers of private property request WS-Montana for assistance to manage predator damage and threats. About 83% of the responses to damage or damage threats by the species in this EA occurred on private lands. Private property includes areas in private and commercial ownership in urban, suburban, and rural areas, including agricultural lands, timberlands, pastures, residential complexes, subdivisions, and businesses.

B. Federal Property

Per the MOUs with the USFS and BLM, WS-Montana responds to permittee and agency requests for predator damage management for protection of livestock on federal grazing allotments, conflicts with resource damage, and threats to public health and safety. WS-Montana coordinates with the agencies prior to the grazing/recreation seasons to identify needs, types of operations, and restrictions (to operational areas, all of which is documented in an Annual Work Plan), and reports annually to the agencies on WS-Montana's activities (Section 1.8). WS-Montana also responds to requests for assistance from the USFWS for protection of ESA-listed species and damage to resources, and threats to human health and safety. Approximately 5.2% of WS-Montana activities occur on federal lands. Coyotes are the primary species taken on BLM and National Forest System lands. Coyote take on National Forest System lands is less than 1% of all coyote take. Coyote take on BLM lands is approximately 5% of the total coyote take. Overall, approximately 5.2% of the total coyote take occurs on federal land.

C. State, County, and Municipal Property

Activities are conducted on properties owned and/or managed by the state, county, or municipalities when requested. Such properties can include parks, forestland, historical sites, natural areas, scenic areas, conservations areas, and campgrounds. Sometimes private landowners that are being affected by predators that reside in habitat located on adjacent public lands may request assistance. The adjacent property owner/manager may agree to allow IPDM activities to occur to assist the affected landowner. WS-Montana can also conduct IPDM activities directly on state and city properties as agents for MFWP when requested, or independently. Less than 2% of WS-Montana activities are conducted on state, county, or municipal lands.

D. Tribal Property

Tribal governments and landowners can request assistance from WS-Montana for predator damage management on lands under their authority and/or ownership. Predators have an important role in tribal culture and religious beliefs. WS-Montana continues to work with tribes to address their needs through consultation for this EA, with policy, and in the field, as requested. WS-Montana conducts work for many different tribes throughout Montana under MOUs with the Fort Peck Assinibione and Sioux Tribes, Blackfeet Nation, Fort Belknap Community Council, Confederated Salish and Kootenai Tribes (CSKT), and Crow Tribe. Work conducted at the request of tribal governments is consistent with tribal decisions, values, and traditions.

Native American tribes may choose to work with relevant cooperating agencies for meeting predator damage management needs, use WS-Montana's services, hire commercial control companies, and/or conduct their own work. Any participating Tribes would need to make their own decision regarding the management alternative they choose to implement. WS-Montana respects the rights of sovereign tribal governments, provides early opportunities for all federally-recognized tribes in Montana to participate in their IPDM planning and developing IPDM strategies for addressing their issues, provides opportunities for participating in WS-Montana NEPA efforts through cooperating agency status, and conducts effective means of engagement through the government-to-government relationship consistent with WS Directive 1040.3 and federal policy.

WS-Montana offered the opportunity to initiate consultation on IPDM actions in Montana and/or participate in preparation of the EA to the Fort Peck Assiniboine and Sioux Tribes, Blackfeet Nation, Fort Belknap Community Council, Chippewa-Cree Tribe, CSKT, Crow Tribe, and the Northern Cheyenne Tribe to identify any potential concerns regarding possible impacts of WS' conflict management activities on tribal cultural properties in Montana (March 28, 2014). Of these tribes, the CSKT and Blackfeet Nation chose to be consulting agencies.

E. Airports

Because habitat for small mammals that represent prey for raptors may be found within fenced active airfields, these predators can become hazards to aircraft during are takeoffs and landings. WS-Montana receives requests for assistance and training from several airport authorities to address threats of aircraft strikes at some of the airports or airbases in Montana and may be requested for assistance at other airports in the future. WS-Montana currently provides services and/or training to several airports in Montana, including Billings Logan International Airport, Great Falls International Airport, Bert Mooney Airport in Butte, Bozeman Yellowstone international Airport, Glacier Park International Airport, Missoula International Airport, L.M. Clayton Airport in Wolf Point, and Yellowstone Airport in West Yellowstone.

Table 1.3. WS-Montana Lethal Take by Land Class, FY2013-FY2017

Land Class	Proportion of Lethal Take by Land Class
Private	92.6%
BLM	4.5%
Forest Service	0.6%
State Land	0.8%
County/City Land	0.4%
Tribal Land	1.1%

1.9.5 For What Period of Time is this EA Valid?

If WS-Montana determines that the analyses in this EA indicate that an EIS is not warranted (impacts are not significant per 40 CFR §1508.27; Section 1.10), this EA remains valid until WS-Montana determines that new or additional needs for action, changed conditions, new issues, and/or new alternatives having different environmental impacts need to be analyzed to keep the information and analyses current. At that time, this analysis and document would be reviewed and, if appropriate, supplemented if the changes would have "environmental relevance" (40 CFR 1502.9(c)), or a new EA prepared pursuant to NEPA.

WS-Montana monitors IPDM activities conducted by its personnel and ensures that those activities and their impacts remain consistent with the activities and impacts analyzed in the EA and selected as part of the decision. Monitoring includes review of adopted mitigation measures and target and non-target take reported and associated impacts analyzed in the EA. Monitoring ensures that program effects are within the limits of evaluated/anticipated take in the selected alternative. Monitoring involves review of the EA for all of the issues evaluated in Chapter 3 to ensure that the activities and associated impacts have not changed substantially over time.

1.9.6 Other applicable WS NEPA Documents

USDA-APHIS-Wildlife Services has prepared a programmatic feral swine environmental impact statement (EIS) to evaluate alternatives for a nationally coordinated feral swine damage management program in the U.S., American Samoa, Guam and the Commonwealth of the Northern Mariana Islands, U.S. Virgin Islands, and Puerto Rico (hereinafter USDA 2015). The Record of Decision (ROD), issued July 2015, selected a nationally coordinated, integrated Feral Swine Damage Management (FSDM) program. The selected alternative in the ROD incorporated all legally available FSDM methods and retained the flexibility to continue to work with local stakeholders under state or local level NEPA decisions, with local stakeholders to manage feral swine damage according to local feral swine management goals. This EA is consistent with the applicable findings, policies, and operational procedures evaluated in the Final EIS (FEIS).

1.10 Why is WS-Montana Preparing an EA Rather than an EIS?

1.10.1 What is the Purpose of an Environmental Assessment?

The primary purpose of an EA is to determine if impacts of the proposed action or alternatives might be significant, or to determine if an EIS is appropriate (40 CFR 1508.9(a)(3) and 40 CFR 1501.4). This EA is prepared so that WS-Montana can make an informed decision on whether or not an EIS is required for the WS-Montana IPDM activities included in this EA.

WS-Montana prepared this statewide EA for its IPDM activities to clearly communicate the analysis of individual and cumulative impacts of its actions to the public using guidance at 40 CFR §1506.6, and to evaluate and determine if there are any potentially significant impacts that may occur from the proposed action and alternatives. This EA also facilitates planning and interagency coordination, streamlines informed decision-making, and provides for timely and effective responses to requests for IPDM assistance.

In order to make this decision, this EA conducts a thorough analysis of direct, indirect, and cumulative impacts associated with WS-Montana assistance to requesting entities in managing predator damage and threats to resources and assets, and threats to human safety and health. WS-Montana addresses all anticipated issues and reasonable alternatives in this EA.

This EA includes thorough and comprehensive analyses of the impacts and effectiveness of five alternative IPDM programs in Montana, including no WS-Montana activities at all (Section 2.3), in compliance with NEPA Section 102(2)(E). It also documents compliance with other environmental laws, such as the Endangered Species Act, describes the current WS-Montana activities and alternatives in detail, and provides rationale for not considering other alternatives and issues in detail.

WS-Montana involves the public in its EA processes by providing for public comment on pre-decisional EAs, and agency involvement through providing for cooperating and consulting agency status and the opportunity to comment on an internal interagency draft prior to public release. WS-Montana will provide a review and comment period of at least 30 days on this pre-decisional draft EA for the public and interested parties to provide comments regarding new issues, concerns, and/or alternatives. Using the guidance provided in 40 CFR §1506.6 for public involvement, WS-Montana will clearly communicate to the public and interested parties the analyses of potential environmental impacts on the quality of the human environment. Public notification processes regarding the availability of the final NEPA document and decision will be identical to that used for the pre-decisional EA, with the addition of direct contact with commenters.

If WS-Montana makes a determination based on this EA that the selected alternative would have a significant impact on the quality of the human environment, then WS-Montana would publish a Notice of Intent to prepare an EIS, and this EA would be the foundation for developing the EIS, per the CEQ implementing regulations (40 CFR §1508.9(a)(3)).

1.10.2 How will WS-Montana Evaluate Significant Impacts

The process for determining if a project or program may have significant impacts is based on the CEQ regulations at 40 CFR §1508.27. WS-Montana will review the impacts evaluated in Chapter 3 of this EA in two ways: the severity or magnitude of the impact on a resource and the context of the impact. For example, context may be considered when the resource is rare, vulnerable, not resilient, or readily changed long-term with even a short-term stressor.

Most of the Intensity Factors (factors) included in 40 CFR §1508.27(b) include the phrase "the degree to which" a particular type of resource might be adversely impacted, not a determination of no adverse impact at all. Therefore, WS-Montana evaluates the impacts to resources and documents the predicted effects in the EA. These effects analyses are used to determine if the levels of impact are indeed "significant" impacts for which a FONSI would not be appropriate. If WS-Montana determines that the levels of impacts are not significant, then the agency will document the rationale for not preparing an EIS in a publicly available FONSI, per the CEQ regulations.

The factors identified in 40 CFR §1508.27 are not checklists, nor do they identify thresholds of impacts; they are factors for consideration by the agency while making the decision regarding whether to prepare a FONSI based on the impact analyses in an EA or an EIS. The agency will determine how to consider those factors in its decision on whether to prepare a FONSI or an EIS. WS-Montana will determine the *degree* to which a factor applies or does not apply to the impacts documented in the EA.

The following discussion outlines how WS-Montana will use this EA and the criteria at 40 CFR §1508.27 to make the decision regarding whether an EA or an EIS is appropriate for the WS-Montana IPDM program.

1.10.2.1 Controversy Regarding Effects

The factor at 40 CFR §1508.27(b)(4) is described as "the degree to which the effects on the quality of the human environment are likely to be highly controversial." The failure of any particular organization or person to agree with every act of a federal agency does not create controversy regarding effects. Dissenting or oppositional public opinion, rather than concerns expressed by agencies with jurisdiction by law or expertise and/or substantial doubts raised about an agency's methodology and data, is not enough to make an action "controversial." This EA evaluates peer-reviewed and other appropriate published literature, reports, and data from agencies with jurisdiction by law to conduct the impact analyses and evaluate the potential for significant impacts. This EA also includes and evaluates differing professional opinions and recommendations expressed in publications where they exist and that are applicable to APHIS-WS informed decision-making (for example, Section 1.12).

A relatively recent comment raised in response to APHIS-WS IPDM EAs in the western United States suggests that scientific controversy exists regarding APHIS-WS removal of predators considered to be at the top of the ecological food chain ("apex predators") that can cause "trophic cascades" resulting in reductions in biodiversity. This comment argues that changes at the top of the food chain (such as in wolves) may result in ecological changes in which other, often smaller predator populations (such as coyotes or foxes) may be released from suppression caused by larger predators. This ecological issue and its cumulative impact analysis are evaluated in detail in Section 3.8.

Commenters also often express concern about the perception of the humaneness of lethal and non-lethal operational methods used by WS-Montana personnel. This issue is considered in detail using the best scientific and professional wildlife management and biology and veterinarian information available (Section 3.9). APHIS-WS recognizes that people may readily disagree on the subjective analysis of the degree to which animals may feel pain and react to short-term and long-term stress associated with capture, immobilization, and euthanasia. This EA includes APHIS-WS Directives and other measures (Section 2.4) that are used routinely by WS-Montana personnel for minimizing the potential for pain and stress on animals in the field.

1.10.2.2 Unique or Unknown Risks

Another concern commonly expressed in comments involves the potential for unknown or unavailable information (40 CFR §1502.22) to potentially result in uncertain or unique or unknown risks (40 CFR §1508.27), especially related to population numbers and trends and the extent and causes of mortality of target and non-target species. Throughout the analyses in Chapter 3 of this EA, WS-Montana uses the best available data and information from wildlife agencies having jurisdiction by law (MFWP and USFWS; 40 CFR §1508.15), as well as the scientific literature, especially peer-reviewed scientific literature, to inform its decision-making. Data provided by livestock producers, especially regarding the economic value of livestock lost to predation as reported for inclusion in the APHIS-WS MIS database, is inherently subjective to some degree, and is therefore used only as an indicator for the costs associated with livestock depredation in Section 1.10.2.

Population and mortality data for many native target species (Section 3.5, Table E.1), such as raccoons, badgers, fox, coyotes, opossums, skunks, and weasels, are typically non-existent from any credible source, in or outside of Montana. WS-Montana recognizes that estimating wildlife populations over large areas can be extremely difficult, labor intensive, and expensive. MFWP, or, for that matter, any state wildlife management agency, has limited resources for estimating population levels and trends for predator species that are not managed as game. Therefore, these state agencies do not directly set population management objectives for these species. States may choose to monitor population health using factors such as sex ratios, age distribution of the population, indices of abundance, and/or trend data to evaluate the status of populations that do not have direct population data. This EA uses the best available information from wildlife management agencies, including MFWP when available, and peer-reviewed literature to assess potential impacts to predator and non-target wildlife species.

If population estimates are available, then the analyses in Chapter 3.5 use the lowest density or number estimates for wildlife species populations (where high and low population estimates are provided in the text) to arrive at the most conservative impact analysis. Coordination with MFWP and the USFWS and providing the opportunity for agency review of and involvement in this EA ensure that analyses are as robust as is possible. The analyses in Section 3.5 provide information for WS-Montana to determine if WS-Montana contribution to cumulative mortality from all sources would adversely affect population levels for each predator species considered.

1.10.2.3 Threatened or Endangered Species, Unique Geographic Areas, Cultural Resources, and Compliance with Environmental Laws

This EA also provides analyses and documentation related to threatened and endangered species, areas with special designations such as wilderness areas, cultural and historic resources, and compliance with other environmental laws, including state laws. This will be used to address the significance criteria at 40 CFR §1508.27(b)(3, 8, 9, and 10).

These issues are evaluated in the following sections:

- Impacts to threatened and endangered species: Section 3.6
- Impacts to unique geographic areas (special management areas): Section 3.11
- Impacts to cultural and historic resources: Section 3.12
- Compliance with the Endangered Species Act: Sections 3.6

1.10.2.4 Cumulatively Significant Impacts

Another common comment involves the criterion for the analysis of "cumulatively significant impacts" (40 CFR §1508.27(b)(7)), which is considered in this EA in various ways.

Many of the issues evaluated in detail are inherently cumulative impact analyses including, for example (Section 3.2):

- Impacts to target species' populations, as each population has many sources of mortality, only one of which is take by WS-Montana;

- Impacts to populations of ESA-listed species, as these species' populations are already cumulatively impacted by many sources of mortality, including loss of habitat, and other stressors, causing them to be listed;
- Potential ecological impacts caused by removal of apex predators, as many ecological factors contribute to any resulting impacts; and
- Potential for lead from ammunition to impact environmental and human factors, as there are many sources of lead in the environment, including lead from hunting activities and ingesting game meat shot with lead ammunition, and lead may chronically enter the environment and people over time (USDA Wildlife Services 2017h).

1.10.2.5 Public and Employee Health and Safety

The concern regarding public health and safety (significance criterion at 40 CFR §1508.27(b)(2)) is evaluated in several analyses in this EA in Chapter 3:

- The potential for humans to ingest lead sourced from ammunition through water and game meat (Section 3.10.2.6)(USDA Wildlife Services 2017h);
- The potential for hazardous chemicals being spilled or leached into surface and groundwater, and being ingested by humans (Section 3.10.2.2)(USDA Wildlife Services 2019i;e;b;j;f);
- The risk of injury to WS-Montana employees during aerial shooting operations (Section 3.10.1.3)(USDA Wildlife Services 2019a;g); and
- The risk of injury to WS-Montana employees while handling hazardous chemicals, being exposed to diseased animals, and the risk of attack by captured animals Sections 3.10.1, 3.10.3)(USDA Wildlife Services 2019i;e;b;j;f).

1.10.2.6 Impacts Can Be both Beneficial and Adverse

Some commenters may believe that an EIS must be prepared, based on 40 CFR §1508.27(b)(1). WS-Montana has the expertise and experience needed to selectively remove predators causing damage. Consequently, WS-Montana management activities may have less population-level impacts than might be seen under take by other entities. In fact, WS-Montana involvement may actually have a beneficial effect on the human environment when compared to the environmental baseline in the absence of such involvement. Environmental effects are identified in Chapter 3 for each alternative (Sections 3.2, and 3.5 -3.13).

1.10.3 What Is the Environmental Baseline Used by WS-Montana to Evaluate Significant Impacts?

To determine impacts of federal actions on the human environment, an environmental baseline needs to be established with respect to the issues considered in detail, so that the impacts of the alternatives can be compared against this baseline. The environmental baseline has been defined to include "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02(d)). This definition is for the USFWS implementation of the ESA; however, the definition is useful in that it clarifies what might be considered as the environmental baseline.

The baseline appropriate for the analyses in this EA is not a "pristine" or "non-human-influenced" environment, but one that is already heavily influenced by human actions and direct management conducted by federal, state, and local agencies, as well as individuals and other entities. The wildlife population baselines are those that are in place under the current condition of the human environment at the present time (or recent past), which means they incorporate and reflect the populations as they have been and are being affected by humans. Effects by humans are caused by sportsman harvest (hunting and trapping), road kill mortality, loss of habitat to development (e.g., construction, logging, and mineral and energy extraction activities), and illegal harvest. Little or no information is available to quantify the effects of some of these actions on the different wildlife species populations. Nevertheless, such effects are already part of the existing human environment.

The environmental baseline is also expected to include PDM and other types of wildlife management by other federal and non-federal entities. Predators are managed under different federal, state, and, on occasion, local laws. Unprotected wildlife species, such as most non-native invasive species, are not protected under state or federal law, and feral domestic animals are typically managed under State and local laws. Most state-resident wildlife species are managed under state authority or law without any federal oversight or protection. MFWP and MDOL have authority to issue permits in Montana for the take of certain wildlife species causing damage (including predators discussed in this EA). When a non-federal entity (MFWP, MDA, MDOL, MLLB, municipalities, counties, private companies, individuals, etc.) takes a management action on a state-resident wildlife species or unprotected wildlife species, the action is not subject to NEPA compliance due to the lack of federal involvement in the action. Under such circumstances, the environmental baseline must be viewed as an environment which includes those species as they are managed or impacted by non-federal entities in the absence of the proposed federal action.

Information necessary to determine the baseline for issues relevant to this EA include data on wildlife populations and trends as well as human recreation, including legal hunting. For wildlife populations, definitive numbers are often not available but can be estimated from the best natural history information available regarding densities and occupied range or habitat types. Current and past harvest information (especially for those species which have current legal hunting/trapping seasons) can be used to assess impacts, because wildlife populations are a renewable resource and a certain percentage can be taken from the population without adverse impacts (i.e., "sustainable harvest").

In some situations, certain aspects of the human environment may actually benefit more from WS-Montana's involvement than from a decision not to assist. For example, many cooperators believe that WS-Montana has greater expertise to selectively remove a target animal than a non-WS entity, due to higher levels of training and experience. In these cases, WS-Montana management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. Thus, in those situations, WS-Montana involvement may actually have a beneficial effect on the human environment when compared to the environmental baseline in the absence of such involvement.

In this EA, we evaluate the impacts of WS-Montana PDM actions by comparing them against the environmental baseline for the human environment which would exist with no federal involvement in PDM in Montana. The analyses in Chapter 3 use the best available information to determine the impacts of the proposed action and alternatives on the current environmental baseline (the human environment as it is today which includes ongoing PDM actions).

1.10.4 How Do Key Statutes and Executive Orders Apply to the WS-Montana Program?

Please review Appendix B for details on all the federal and state laws and EOs relevant to the WS-Montana program. This section addresses Montana-specific application of highly relevant laws.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)

All pesticides used, or recommended for cooperator use, are registered with and regulated by the U.S. Environmental Protection Agency (EPA) and MDA. WS-Montana uses, or recommends for use, all chemicals according to label requirements as regulated by EPA and MDA.

Endangered Species Act (ESA)

WS-Montana has consulted with the USFWS regarding its current program. See Sections 2.4 and 3.6 for details on consultations and results.

National Historic Preservation Act

WS-Montana has reviewed its activities as described in this EA and continues to conclude that the program is not an “undertaking” as defined by National Historic Preservation Act (NHPA) and that consultation with the State Historic Preservation Office (SHPO) is not necessary (Letter to Dr. Baumler, SHPO, November 19, 2014). WS-Montana works closely with the USFS and BLM on public lands to ensure there are no conflicts with cultural resources. WS-Montana has also sent draft copies of this EA to tribes as discussed under “Consultation and Coordination with Indian Tribal Governments” in this section, and the tribes have not identified cultural issues of concern to the tribes outside of issues already addressed in existing MOUs. Each of the methods described in the EA that may be used operationally and locally by WS-Montana does not cause major ground or even minor disturbance, does not cause any physical destruction or damage to property, does not cause any alterations of property, wildlife habitat, or landscapes, and does not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that are used by WS-

Montana are not generally the types of activities that would have the potential to affect historic properties.

Although not foreseen, if WS-Montana is requested to assist with a wildlife damage problem that could potentially cause more than minor ground disturbance on public lands, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

Consultation and Coordination with Indian Tribal Governments (EO 13175).

WS-Montana recognizes the rights of sovereign tribal nations, the unique legal relationship between each Tribe and the federal government, and the importance of strong partnerships with Native American communities. WS-Montana is committed to respecting tribal heritage and cultural values when planning and initiating wildlife damage management programs. Consultation and coordination with tribal governments is conducted consistent with EO 13175 and APHIS-WS' plan implementing the EO. WS-Montana has offered early opportunities for formal government-to-government consultation on its proposed program to all Tribes in Montana, and has requested their involvement for this EA through direct invitations (April 2016). Agency draft EA review opportunities were extended to the Blackfeet Nation, the Confederated Salish and Kootenai (CSKT), Northern Cheyenne, Chippewa-Cree, Crow, Fort Peck, and Fort Belknap Tribes (Email 08/19/ 2020 and 10/07/2020; Certified mail 08/20/2020).

Fish and Wildlife Act of 1956 Section 742j-1 – Airborne Hunting

The USFWS has delegated permitting of aerial shooting to the MDOL. MDOL has determined that WS-Montana does not need to obtain a state permit from them because the APHIS-WS program has federal jurisdiction and authority. Instead, a Cooperative Service Agreement and MOU outline the responsibilities of each agency (Section 1.8). Other commercial, private, and lower governmental entities must obtain a permit from MDOL for use of aerial operations for predator removals (Section 1.8).

Compliance with Executive Order 12898 "Environmental Justice"

WS-Montana personnel use damage management methods as selectively and environmentally conscientiously as possible. All chemicals used by APHIS-WS are regulated by the EPA through FIFRA, MDA, by MOUs with federal land managing agencies, and by APHIS-WS Directives. Based on a risk assessment conducted in Section 3.10 of this EA, APHIS-WS concluded that when APHIS-WS program chemicals are used following label directions, they are highly selective to target individuals or populations, and such use has negligible impacts on the environment. The WS-Montana operational activities properly dispose of any excess solid or hazardous waste and have been found to manage its chemicals appropriately (OIG Report 2015; Section 3.10.2). It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

Executive Order 13045 "Protection of Children"

Children may suffer disproportionately from environmental health and safety risks, including their developmental physical and mental status, for many reasons. APHIS-WS policy is to identify and assess environmental health and safety risks and avoid or minimize them, and WS-Montana has considered the impacts that alternatives analyzed in this EA might have on children. All WS-Montana predator damage management is conducted using only legally available and approved damage management methods where it is highly unlikely that children would be adversely affected. See Appendix A for a detailed description of all damage management methodologies included in the WS-Montana program and Section 3.10 for an analysis of their risks and impacts.

The Wilderness Act

The Wilderness Act preserved management authority for fish and wildlife with the state for those species under state jurisdiction (Sec. 4(d)(8). Some portions of wilderness areas in Montana have historic grazing allotments, and WS-Montana may be requested to conduct limited damage management and threats to human health or safety in compliance with federal and state laws. WS-Montana only provides assistance to requesting entities in designated wilderness areas when allowed under the provisions of the specific wilderness legislation and as specified in MOUs between APHIS-WS and the land management agencies.

The Wilderness Act does not prohibit IWDM within designated wilderness. The Act did leave management authority for fish and wildlife with the state for those species under their jurisdiction. With certain exceptions, the Act prohibits using motorized equipment and motorized vehicles such as ATVs and landing of aircraft. The Forest Service and BLM may approve wildlife damage management in wilderness study areas and wilderness (FSM 2323 and BLM Manuals 6330 and 6340, respectively). WS-Montana works closely with the BLM and Forest Service to cooperatively implement their respective interagency MOUs and agency policies for operations in WAs and WSAs (Section 3.11).

See Section 3.11 for evaluation of impacts in special management areas (SMAs), including WAs and WSAs.

1.11 What are the Needs for the WS-Montana Predator Damage Management Program?

1.11.1 What is the Need for WS-Montana IPDM Activities?

Two independent government audits, one conducted at the request of Congress, the other based on complaints from the public and animal welfare groups to the U.S. Department of Agriculture (Section 1.12.2), found that, despite cooperator implementation of non-lethal actions such as fencing and herding, a need exists for APHIS-WS' predator damage management activities. APHIS-WS management actions for predator damage was determined by these audits to be needed for protection of human safety and health; protection of crops and livestock; and protection of property and other assets.

As stated in Section 1.4.3, in some cases, cooperators are likely to tolerate some damage and loss until it reaches a threshold where it becomes an economic, physical, or emotional burden. The appropriate threshold or level of tolerance before using non-lethal and lethal methods differs among cooperators, their economic circumstances, and the extent, type, duration, and chronic nature of damage situations. The level of tolerance would be lower for situations in which human safety or the potential for disease transmission threats from wildlife to humans exists. For example, action must be taken immediately in the case of aircraft striking predators at an airport that can lead to significant property damage and risks to passengers, or when a coyote acting aggressively in a residential area might be habituated or diseased. In cases where individuals are concerned with the threat of damage, they may have experienced damage in the past, resulting in lower levels of tolerance.

WS-Montana recognizes that increasing numbers of people moving into rural areas or living in urban areas are often anxious over wildlife encounters-especially with predators. Therefore, WS-Montana commonly provides technical assistance including advice, training, and educational materials to improve coexistence between people and wildlife and reduce the potential for conflicts. WS-Montana is also expanding its direct operational assistance with non-lethal methods by assisting cooperators in setting up fencing and deterrents such as lights. In some cases, responding to requests for assistance provides an overall benefit to the wildlife species causing damage. For example, swift, targeted responses to grizzly bear damage provide rural communities with a mechanism to coexist with this them, thus building social tolerance in a landscape where grizzly bears were once persecuted.

Whenever possible, WS-Montana personnel recommend that cooperators take non-lethal action in lieu of, or in addition to, direct and sometimes lethal actions taken by WS-Montana personnel. However, the appropriate strategy for a particular set of circumstances must be determined on a case-by-case basis, using the WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b).

1.11.2 What is the Need for IPDM to Protect Livestock in Montana?

Predators are responsible for preying upon a wide variety of livestock, including cattle, sheep, goats, swine, horses, and poultry. Sheep, goats, cattle (especially calves), and poultry are highly susceptible to predation throughout the year (Henne 1975, Nass 1977, Tigner and Larson 1977, O'Gara et al. 1983, Bodenchuk et al. 2002). For example, cattle, calves, sheep, and goats are especially vulnerable to predation during calving, lambing, and kidding seasons in the late winter and spring (Sacks et al. 1999b, Bodenchuk et al. 2002, Shwiff and Bodenchuk 2004).

Not all livestock producers suffer losses to predators. However, for those who do, these can be substantial, and may cause significant losses to smaller operations (Fritts et al. 1992, Mack et al. 1992, Shelton 2004, Rashford et al. 2010). Losses are not evenly distributed among producers, and may be concentrated on some properties where predator territories may overlap livestock occurrence and predators may switch to domestic livestock as an alternative food source (Shelton and Wade 1979, Shelton 2004). Therefore, predation can disproportionately affect certain properties and further increase a single producer's losses (Nass 1977, Howard Jr. and Shaw 1978, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002, Shelton 2004, Rashford et al. 2010).

Shwiff and Bodenchuk (2004) state that profit margins in livestock production cannot allow much of a loss rate, and the absence of IPDM, such losses would likely result in the loss of the livestock enterprise. Without effective methods of reducing predation rates such as those used by APHIS-WS, economic losses due to predation continue to increase

(Nass 1977, Howard Jr. and Shaw 1978, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002).

1.11.2.1 What is the Contribution of Livestock to Montana's Economy?

Agriculture is extremely important to Montana's economy. A comparison of selected Montana industries shows agriculture is the largest of all sectors (National Agricultural Statistics Service 2016). Montana is comprised of approximately 94 million acres of which about 60 million (64%) are operating farms and ranches (National Agricultural Statistics Service 2016). About 66% of that acreage was used solely for pasture and range (National Agricultural Statistics Service 2016). In 2013, agriculture accounted for more than 6% of Montana's gross domestic product (Wagner 2014). In 2015, the value of the agricultural sector production in Montana was about $4.7 billion (National Agricultural Statistics Service 2016). Of this, livestock production accounted for about 46% of total agricultural sector production (National Agricultural Statistics Service 2016) and is, therefore, considered a primary agricultural industry sector in the state. In 2015, the total cash value from sales of livestock and livestock products was about $1.87 billion in Montana (National Agricultural Statistics Service 2016).

Successful IPDM includes focusing on effective methods and strategies to prevent losses from occurring by protecting the livestock at risk. It is much easier to estimate damage or loss costs, rather than to place a value what is being protected by implementing preventative IPDM. One way to assess the value of what is being protected is to multiply the quantity of the resource with the direct market value of those resources. The National Agricultural Statistics Service (2016) reported estimates of livestock inventories in Montana in 2016, including 2,650,000 head of cattle and calves and 230,000 head of sheep and lambs. Not all resource owners request assistance of WS-Montana. However, WS-Montana estimates that it provided IPDM activities in fiscal year (FY) 2019 for the protection of a minimum of 826,937 cattle and calves worth an estimated $1.6 billion; 241,796 sheep and lambs worth an estimated $59 million; 6,475 horses and mules worth an estimated $21 million; 9,687 goats and kids worth an estimated $1.5 million; and 2040 beehives worth an estimated $1.5 million.

1.11.2.2 What Do Studies Say About the Numbers of Livestock Losses Due to Predators?

Livestock losses can come from a variety of sources, including disease, weather conditions, and predation (Blejwas et al. 2002). Producers routinely address disease concerns through responsive and preventative veterinary care and weather concerns through husbandry practices. These concerns must be dealt with by producers as part of their business operation. However, this EA addresses livestock losses through predation and in the context of APHIS-WS statutorily authorized activities and appropriations and, therefore, focuses on this issue.

Loss rates of different types of livestock in the presence and absence of IPDM can vary widely. It is difficult to compare the findings of studies because of different study methodologies, locations, circumstances, survey methods, whether losses are reported or confirmed, lack of finding all animals depredated, and variables that cannot be controlled during the studies, such as weather and disease. However, these findings can be an indicator of levels of losses with and without IPDM activities:

- Losses in the absence of direct IPDM activities have been estimated to include:
    - Adult sheep ranging from 1.4% to 8.4%, lambs ranged from 6.3% to 29.3% (Shwiff and Bodenchuk 2004);
    - Adult doe goat losses were 49% and kids 64% (Guthery and Beasom 1978);
    - Lambs ranged from 12% to 29% and ewes 1% to 8% when producers were compensated for losses in lieu of IPDM (Knowlton et al. 1999);
    - Adult sheep 5.7% (range 1.4% to 8.1%), lambs 17.5% (range 6.3% to 29.3%), and calves (3%) (Bodenchuk et al. 2002);
    - Total sheep flock ranged from 3.8% in California to almost 100% of lambs in a South Texas study (Shelton and Wade 1979);
    - Adult sheep and lambs can range from 8.3% to 29.3%, respectively ((Henne 1975), (Munoz 1977), (O'Gara et al. 1983));
    - Lambs could be as high as 22.3% ((McConnell 1995) in: Houben et al. (2004)).
- Losses with direct IPDM activities in place:
    - Adult sheep 1.6%, lambs 6%, goats and kids 12%, and calves 0.8% (Bodenchuk et al. 2002);
    - Lambs 1% to 6% (Knowlton et al. 1999);
    - Lamb losses can be as low as 0.7% ((Nass 1977), (Tigner and Larson 1977), (Howard Jr. and Shaw 1978), (Wagner and Conover 1999), (Houben et al. 2004);
    - Lamb loss proportion to coyote predation was reduced from 2.8% to less than 1% on grazing allotments in which coyotes were removed 3 to 6 months before summer sheep grazing (Wagner and Conover 1999).

1.11.2.3 What Are Livestock Losses to Predators Nationally?

Since 2015 , the USDA, APHIS, Veterinary Services (VS) program has assumed the role of reporting on livestock losses such as are found in “Death loss in U.S. cattle and calves due to predator and nonpredator causes, 2015” and “Sheep and lamb predator and nonpredator death loss in the United States, 2015” (USDA Veterinary Services 2015) from NASS.

The USDA Veterinary Services (2015) Sheep and Lamb Predator and Nonpredator Death Loss in the United States, 2015 report indicates that losses due to predators represented 28.1% of the total loss of sheep and 36.4% of all losses of lambs from all types of mortality, accounting for 194,395 sheep and lambs killed (valued at $32.5 million). Of these losses to predators, 91.4% of them occurred from known predator species, whereas 8.6% occurred from unknown species (USDA Veterinary Services 2015).

Table 1.4. From the Percentage of Total Losses Attributed to Specific Predator Species and the Associated Amount of Damage in Terms of Head of Cattle-Calves (USDA Veterinary Services 2017) and sheep-lambs (USDA Veterinary Services 2015).

	% Total Predator Loss				Number of Head			
Predator Species	**Cattle**	**Calves**	**Sheep**	**Lambs**	**Cattle**	**Calves**	**Sheep**	**Lambs**
Coyotes	40.5	53.1	54.3	63.7	16,880	126,810	33,498	84,534
Dogs	11.3	6.6	21.4	10.3	4,700	15,740	13,223	13,701
Foxes	1.5	0	0.5	1.9	610	82	317	2,460
Wolves	4.9	3.4	1.3	0.4	2,040	8,110	830	500
Mountain Lions and Bobcats	5.8	5.7	6.7	7.3	2,430	13,580	4,158	9,656
Bears	4	2.1	5.0	3.0	1,680	4,940	3,090	4,018
Ravens	n.a.	0.5	0.4	1.5	n.a.	1,157	242	1,988
Feral swine	n.a.	n.a.	0.4	0.7	n.a.	n.a.	231	872
Other[2]	32.1	28.7	10	11.2	13,350	68,470	6,125	14,955

[1] Others includes vultures, eagles, and unknown predators. For a full description of losses due to all predator species reported see Table C.7 USDA Veterinary Services (2015).
[2] Others includes vultures, eagles, and unknown predators. For a full description of losses due to all predator species reported see tables D.1.a and D.2.a (USDA Veterinary Services 2017).

In addition, 31,215 sheep and lambs were injured but not killed, valued at $5.1 million (USDA Veterinary Services 2015). The combined losses occurred despite sheep operators increasing their utilization of non-lethal methods in 2014 (58% of sheep operations) as compared to 2004 (31.9%). These included guard dogs (40.5%), fencing (54.8%), shed lambing (34.4%), and night penning (33.7%) (USDA Veterinary Services 2015)(USDA 2015).

Predation on adult cattle in 2015 was reported at 2.4% of all losses and accounted for 41,700 animals, whereas predation on calves was 11.1% of total mortality and accounted for 238,900 calves. These losses (valued at $180.1 million) occurred despite approximate 6-fold increase in the use of non-lethal methods among cattle operations from 3.1% in 2000 to 19% in 2015 (USDA Veterinary Services 2017).

1.11.2.4 Which Predators Cause the Most Predation on Livestock?

Of the predators that kill livestock, coyotes are considered a widespread problem (Knowlton et al. 1999) and are responsible for the highest percentage of livestock depredation (Shelton 2004, National Agricultural Statistics Service 2005;2006;2011, USDA Veterinary Services 2015;2017). In a study of sheep predation conducted on rangelands in Utah (Palmer et al. 2010), coyotes accounted for the majority of lamb losses at 67%, with fewer losses attributed to mountain lions (31%) and black bears (2%). Other predators that cause measurable predation on cattle, calves, sheep, and lambs in Montana are wolves, black bear, grizzly bear, mountain lion, red fox, feral or free-roaming dogs, bobcats, and ravens. While predation by wolves, grizzly bears, black bears, and mountain lions is not as frequent as coyote predation, the damage caused by these species can negatively impact producers (USDA Veterinary Services 2015;2017).

Although, in general, wolf and grizzly bear predation rates are lower than those of coyotes, wolves and grizzly bears, these can also occasionally be responsible for the surplus killing of sheep and lambs where one or more predators do not consume, or partially consume, killed animals (Shaw 1987). For instance, WS-Montana has documented cases of an individual grizzly bear killing over 70 sheep over several days.

Predators may also frighten sheep, causing stampedes which can result in animals suffocating as they pile up on top of each other in confined areas, such as along the bottom of a drainage or in corrals.

1.11.2.5 What are Livestock Losses to Predators in Montana?

Damage reported to WS-Montana, by resource owners, such as predation or injury to livestock, is recorded in the APHIS-WS MIS database as "reported" damage. If WS-Montana employees are able to verify that the damage occurred, it is recorded in MIS as "verified" damage, defined as resource or production losses examined by a WS-Montana employee during a site visit and determined to have been caused by a specific predator species. For more details on methods of field evaluation by WS-Montana personnel, see Section 2.3.1.3.

Damage and the associated estimated monetary values reported to, or verified by, WS-Montana personnel varies annually due to changes in the number of requests for assistance, the value of the resource being damaged, and fluctuation of both livestock and predator populations. The monetary losses from livestock predation reflect losses that have occurred and that have been reported to or verified by WS-Montana. However, these are not necessarily reflective of all livestock losses occurring in Montana since not all livestock lost to predators are reported to WS-Montana. Montana livestock producers reported to WS-Montana losses of 16,829 head of livestock valued at $6,157,451 during FY2013 to FY2017. According to WS-Montana MIS data, coyotes, wolves, and grizzly bears inflicted the most damage in value ($3,025,797, $1,734,948, and $721,325, respectively); 49%, 28%, and 12% of losses were caused by coyotes, wolves, and grizzly bears, respectively. WS-Montana was able to verify approximately 26% of all the livestock losses reported to WS-Montana. Verification of damage is more likely when compensation for livestock losses is available. For example, 53% of livestock losses caused by grizzly bears were verified by WS-Montana, whereas 40% of livestock losses caused by black bears were verified.

Using a recent USDA APHIS Veterinary Services survey (USDA Veterinary Services 2017) in which Montana data were included, predators killed 930 cattle and 6,340 calves in Montana. More recently, the value of cattle and calves injured but not killed by predators in Montana in 2015 was reported as $223,000 (USDA Veterinary Services

2017), assuming the animals had no value after the injury. National Agricultural Statistics Service (2015), USDA Veterinary Services (2015) reports that 3,000 sheep and 7,470 lambs were killed by predators in Montana in 2014, with the value of $622,500 and $1,337,000, respectively. A summary of the percent of livestock losses caused by each predator species in Montana is shown in Table 1.5 and number and value by predator and type of livestock is summarized in Table 1.6.

Table 1.5. The Percentage Total Predator Loss in Montana of Cattle, Calf, Sheep, and Lamb Losses Attributed to a Particular Predator Species (USDA Veterinary Services 2015;2017).

Predator Species	% Cattle loss	% Calf loss	% Sheep loss	% Lamb loss
Coyotes	22.1	41.5	79.2	84.3
Mountain lions/ Bobcats[1]	24.3	2.5	6.6	1.8
Bears	25.8	13	6.3	1.5
Dogs	0	0	3.2	1.6
Wolves	10.2	12.8	2.2	0.6
Other	0	4.8	1.3	6.6
Unknown	17.6	25.4	1.2	3.5
Total	100	100	100	100

[1] For sheep and lambs, loss to mountain lions and bobcats were combined (USDA Veterinary Services 2015).

Table 1.6. Head of Livestock Depredated or Injured by Predators Reported to or Verified by WS-Montana and the Estimated Combined Total Value[1] for FY2013 – FY2017 (MIS 2018).

	Livestock Resource											
	Sheep		Cattle		Equine		Goats		Others[2]		Total	
Species	#	Value	#	Value	#	Value	#	Value	#	Value	#	Value
Coyote	9,554	$1,461,660	1,567	$1,545,885	4	$7,276	59	$9,902	62	$973	11,246	$3,025,697
Gray Wolf	126	$46,820	1,900	$1,642,608	12	$38,167	19	$53,656	41	$3,975	16,829	$1,733,448
Grizzly Bear	176	$40,504	431	$641,279	4	$6,319	5	$720	102	$12,503	718	$701,325
Black Bear	580	$97,524	50	$59,075	-	-	37	$8,966	542	$147,450	1,209	$313,015
Raccoon	-	-	-	-	-	-			52	$519	52	$519
Mountain Lion	506	$101,990	46	$54,734	22	$13,930	114	$30,409	67	$77,586	755	$278,649
Red Fox	170	$26,637	-	-	-	-	-	-	240	$4,178	410	$30,815
Bobcat	12	$1,335	-	-	-	-	2	$730	22	$905	36	$2,969
Badger	-	-	-	-	-	-	-	-	-	-	-	-
Feral Cat	-	-	-	-	-	-	-	-	-	-	-	-
Common Raven	67	$7,896	60	$42,281	-	-	-	-	98	2,041	225	$52,219
Striped Skunk	-	-	-	-	-	-	-	-	-	-	-	-
Feral Dog	64	$8,517	15	$10,227	-	-	1	50	-	-	80	$18,794
Total	11,255	$1,792,883	4,069	$3,996,089	42	$65,693	237	$53,656	1,226	$249,130	16,829	$6,157,451

[1] Dollar values are based on nationally calculated averages or are reported by the producer.
[2] Others include alpacas, beefalo, llamas, domestic fowl, guard animals, bison, swine, and beehives.

1.11.2.6 What are livestock producers doing to prevent predation?

Overall use of non-lethal methods by Montana producers was higher than the national average, with 86.4% of all survey respondents reporting using at least one nonlethal method (K. Marshall, APHIS National Animal Health Monitoring System, 2016, unpublished data). Table 1.7 shows the percentage of Montana producers surveyed that used non-lethal strategies to prevent losses of cattle, calves, (National Agricultural Statistics Service 2012) and sheep (National Agricultural Statistics Service 2015, USDA Veterinary Services 2015) from predators in Montana. Culling refers to the removal of older and more vulnerable livestock from the inventory.

Table 1.7. Percentage of Montana Livestock Operations Utilizing a Specific Non-lethal Method for Protection of Cattle & Calves or Sheep. (Producers can utilize more than one non-lethal method simultaneously; (National Agricultural Statistics Service 2012, USDA Veterinary Services 2015).

Non-lethal Method	Cattle and Calves (%)	Sheep and Lambs (%)
Guard dogs	34.6	38.9
Exclusion fencing	3.1	37.2
Frequent checks	26.6	34.5
Carcass removal	36.9	24.5
Culling	30.1	23.4
Night penning	19.8	48
Herding	12.7	7.9
Fright/harassment tactics	4.4	6.5
Shed lambing	-	49
Llamas	-	24
Changing bedding	-	12.2
Donkeys	-	9.3
Other	17.1	9.9

After receiving a request for assistance, WS-Montana assesses the situation to determine if the non-lethal methods previously conducted by the landowner were appropriate and carried out correctly, given the circumstances. Additional non-lethal methods may be recommended and or implemented by WS-Montana if deemed potentially effective by field personnel; sometimes, however, resolution of the conflict requires supplemental lethal control.

WS-Montana is typically contacted by landowners who have attempted several non-lethal strategies on their own. In FY2016, producers requesting assisting from WS-Montana who use non-lethal methods report using an average of 3.3 non-lethal methods per year (MIS 2018). Of producers requesting assistance from WS-Montana and using non-lethal methods, producers report using exclusion fencing (44.9%), guard animals (41.4%), shed lambing (26.5%), and harassment (16.6%). Additional non-lethal methods producers report using include relocating livestock or changing pastures (34.7%), changing animal husbandry methods (29.6%), confining livestock, for example night penning (28.3%), herding (15.5%), and eliminating attractants such as feed (12.3%). Percentages are annual averages for FY2015 and FY2016 (MIS 2018).

Appendix A provides more detail on both non-lethal and lethal IPDM methods.

1.11.2.7 How Many Requests for Assistance Occur in Montana?

Requests for assistance represent an index to the level of need for IPDM work to be conducted by WS-Montana, but these requests likely represent only a portion of the actual need. For example, Connolly (1992) determined that only 19% of the total adult sheep and 23% of the lambs actually killed by predators are reported to or verified by USDA Wildlife Services nationally.

WS-Montana personnel record their requests for assistance in the WS MIS database. Each response is recorded as a Work Task, documenting the species and resource(s) that are in conflict. A Work Task is defined as a single visit to a property or contact by WS-Montana personnel to provide technical assistance, to conduct a wildlife damage field evaluation/assessment/investigation, or to continue work on an IPDM activity/project in progress. The number of work tasks serves as an index of the intensity of effort or responses by WS-Montana personnel to address incidents involving the particular species which are impacting particular resources. Reports of these conflicts do not represent the number of individual landowner requests for service, but rather the number of responses by WS-Montana for those types of resource/species combinations. This information can describe the frequency of responses to requests for assistance.

At the time of providing a response to an individual request for service, WS-Montana may provide a requester with information, demonstrations, recommendations for strategies that the landowner may implement (technical assistance), and/or direct assistance in which the WS-Montana employee takes direct action to address the predator situation. As an individual situation may involve one or more predators causing damage to more than one resource, the conflict data recorded for the field visit cannot be used to determine the number of unique requests for assistance for each predator and/or livestock animal.

The average number of livestock conflicts WS-Montana recorded for the species in this EA is over 8,894 responses (Work Tasks) per year between FY2013 and 2017. Out of the total number of responses, predator damage to livestock comprises 95% or an average of 8,460 responses per year. Of all the resources in the livestock group, calves, lambs, and sheep are the resources most frequently in conflict with predators, at 43.4%, 34.7%, and 15%, respectively. 74.3% of the conflicts with livestock were associated with damage or threat of damage from coyotes and 13.2% were associated with wolves, with other predators contributing a smaller proportion each (Table 1.8).

While there has not yet been a request for assistance with feral swine damage in Montana, the presence of a large number of feral swine near the border in Saskatchewan, Canada makes it highly probable that WS-Montana will be requested to manage feral swine damage in the state in the foreseeable future given their potential for property damage and as reservoirs for diseases of public and animal health diseases with the potential to become economically important. In the event of a request by cooperators for assistance in managing feral swine damage, WS has prepared a programmatic feral swine Environmental Impact Statement (EIS) to evaluate alternatives for a nationally coordinated feral swine damage management program (USDA Animal and Plant Health Inspection Service et al. 2015). The Record of Decision (ROD), issued July 2015, selected a nationally coordinated, integrated Feral Swine Damage Management (FSDM) program. The selected alternative in the ROD incorporated all legally available FSDM methods and retained the flexibility to continue to work with local stakeholders under state or local level NEPA decisions, with local stakeholders to manage feral swine damage according to local feral swine management goals. This EA is consistent with the applicable findings, policies, and operational procedures evaluated in the Final EIS (FEIS).

Table 1.8. Percentage of Livestock-Related IPDM Work Tasks by Predator Species Recorded by WS-Montana: FY2013 – FY2017.

Species	Percentage of Work Tasks
Coyote	74.3
Gray Wolf	13.2
Red Fox	6.1
Grizzly Bear	2.3
Black Bear	1.6
Mountain Lion	1.6
Striped Skunk	<1
Raccoon	<1
Feral Cat	<1
Bobcat	<1
Badger	<1
Feral Dog	<1
Raven	<1

1.11.2.8 How Does WS-Montana Cooperate with Other Entities in Managing Grizzly Bear, Black Bear, and Mountain Lion Damage to Livestock?

WS-Montana cooperatively works with MFWP, USFWS, USFS, counties, and/or private individuals to assist them in managing wildlife damage, threats, or complaints. An MOU between MFWP and WS-Montana clarifies the roles of the two agencies in responding to complaints involving grizzly bears, wolves, black bears, and mountain lions (Section 1.8). WS-Montana is responsible for responding to livestock complaints or livestock depredations involving grizzly bears, gray wolves, black bears and mountain lions, and MFWP is responsible for responding to non-livestock complaints including public and pet safety issues. Livestock loss compensation is available if WS-Montana investigates and determine that depredations are caused by grizzly bears, wolves, and, as of 2017, mountain lions.

Damage management efforts are closely associated with individual damage complaints and are designed to manage only the animal creating the damage situation. In Montana counties where WS-Montana is not under agreement for assistance, MFWP, landowners or their agents, or private county contractors may conduct PDM efforts in the absence of WS-Montana Cooperative Service Agreements.

MFWP and WS-Montana receive numerous complaints from concerned citizens regarding wildlife-livestock conflicts. WS-Montana records these complaints using Investigative Report Forms. Grizzly bears, black bears, wolves, and mountain lions occasionally cause damage to land or crops (e.g. grain storage containers and corn fields); however, most damage complaints occur when these species prey upon, or attempt to prey upon, livestock. Many complaints associated with these species being present near livestock are initially handled by MFWP or WS-Montana using non-lethal technical assistance (Appendix A), including advice, training, and educational materials to improve coexistence between people and wildlife and reduce the potential for conflicts. Once livestock depredations occur, complaints made to MFWP are forwarded to WS-Montana. WS-Montana can also receive requests for assistance directly from resource owners and directly provide services for livestock associated complaints.

A complaint filed with WS-Montana can be for one or multiple animals that may be responsible for the damage of a particular resource or property. Therefore, the number of complaints does not necessarily indicate how many individual animals were involved, but rather the frequency of damage occurrences in Montana during a year (Table 1.9). Property owners, who must report the take to MFWP, may also take depredating animals. Therefore, it is not possible to know with certainty the total number of animals involved.

Table 1.9. Number of Investigative Reports Completed by WS-Montana for Grizzly Bear, Wolf, Black Bear, and Mountain Lion Depredation Complaints during FY 2013 - FY2017.

License/Calendar Year	# of Grizzly Bear Complaints	# of Black Bear Complaints	# of Mountain Lion Complaints	# of Gray Wolf Complaints
	WS-Montana	**WS-Montana**	**WS-Montana**	**WS-Montana**
2013	25	37	35	129
2014	46	26	37	92
2015	88	35	42	91
2016	84	16	37	103
2017	98	13	22	102

1.11.2.9 What Proportion of WS-Montana Livestock Conflict Work Occurs on Public and Private Lands?

Montana comprises over 94 million acres (147,040 square miles), with approximately 29% under the jurisdiction of federal agencies (USFS 18%, BLM 8.5%, NPS 1.2%, USFWS 1.3%, and other 0.4%). Private lands comprise approximately 62.6%, state lands approximately 5.5%, and Tribal lands approximately 2.9% (National Wilderness Institute 1995, Natural Resources Council of Maine Undated). In Montana, predator conflicts specific to livestock occur mostly on private land (88.7%), followed by BLM lands (4.2%), USFS lands (1.7%), state lands (0.7%), tribal lands (0.6%), and undeclared land classes (4%). Between FY13 and FY17 WS-Montana worked on agreements totaling an average of 11,429,861.8 acres, approximately 12% of the state, per year. Within the areas under agreement, PDM is generally only conducted in small proportions of the total area. The primary livestock grazing use of these lands is for cow-calf production and production of range bands of sheep. BLM lands in Montana tend to be highly "checkerboarded" with private land, and work on one land class may actually benefit livestock on another land class, especially near the property lines. Because of the mobility and large home ranges of coyotes, and other large predators, some IPDM is conducted adjacent to private lands on BLM and FS grazing allotments in order to provide adequate and efficient livestock protection.

The need for IPDM activities on public lands depends upon the type of livestock, time of year, and location where they are grazed. Most cattle grazing on public lands occurs when calves are older and therefore less vulnerable to coyote predation when put onto grazing allotments. As sheep and lambs are smaller than cattle, sheep tend to be more susceptible to predation than cattle at all times of year. Additionally, lambs are put on allotments shortly after birth when they are more vulnerable to predation by coyotes and other predators. Producers frequently report damage and request assistance from WS-Montana during the spring season when younger livestock are more susceptible to predation

The need to conduct IPDM on public lands occurs primarily in northeastern and southwestern Montana where the majority of livestock grazing on USFS and BLM occurs. The primary predators of concern on USFS and BLM land are coyotes and wolves. Table 1.10 summarizes livestock losses by land classification.

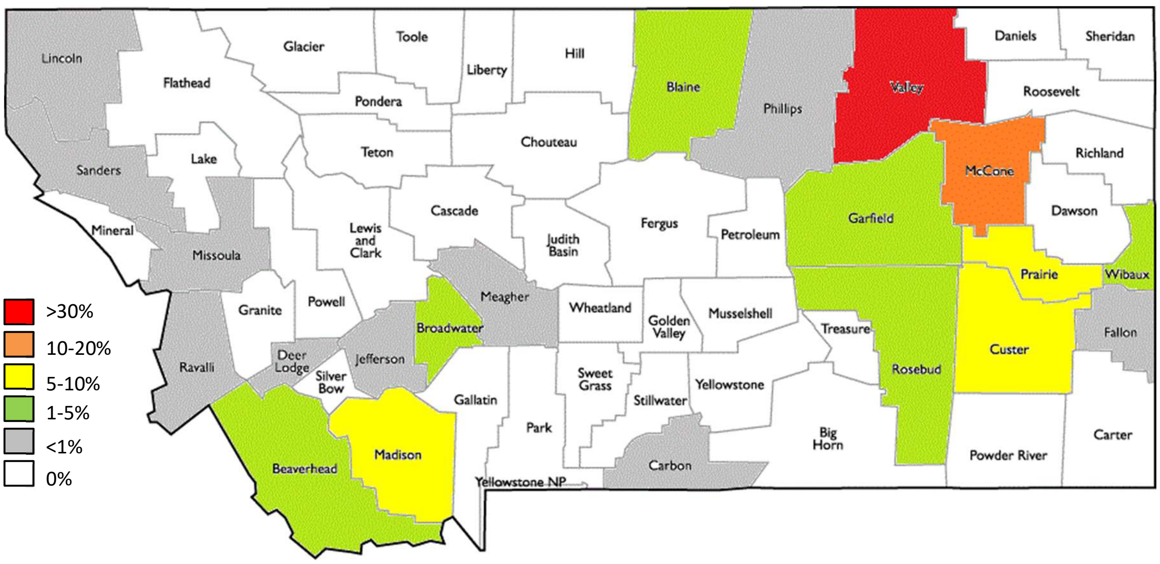
Table 1.10. Summary of the Number of Livestock Lost to Predators and Reported or Verified by WS-Montana by Land Class (FY2013-FY2017).

Land Class	Cattle	Sheep	Goats	Equine	Beehives	Others[1]	Total
Private	3,331	10,777	150	30	528	334	14,817
USFS	329	219					548
BLM	68	118					186
State	10						10
Tribal	55	13	1	4			262
USFWS	1						1
Undeclared	85	128	86	8	19	345	326
Total	4,069	11,255	237	42	547	679	16,150

[1] Others include alpacas, beefalo, llamas, domestic fowl, guard animals, bison, and swine.

Of the predators taken by WS-Montana, the proportion for each land class was calculated for each county between FY2013 and FY2017. In 32 out of 53 counties in which WS-Montana works, no predators were lethally removed on federal lands. The percent of predators lethally removed on federal lands in each county is shown in Figure 1.1. Across Montana, 5.1% of all predators lethally removed by WS-Montana are taken on federal lands (Table 1.3).

Figure 1.1. Proportion of predators lethally removed by WS-Montana on federal lands versus other ownership classes by county during FY2013-FY2017.



1.11.2.10 What Diseases Do Predators Transmit to Livestock in Montana?

In addition to direct livestock losses to predators through predation and injury, livestock can also be impacted by a number of diseases transmissible from predators, including rabies (raccoons, skunks, foxes, coyotes); leptospirosis (canines, raccoons, opossums, feral swine); *Neospora caninum* and the tapeworm *Echinococcus granulosus* (feral dogs, wolves, coyotes, and fox); classic swine fever virus, *Brucella suis*, and *Trichinella spiralis* (feral swine); and *Toxoplasma gondii* (domestic cats)(Gondim et al. 2004a, Gondim et al. 2004b, Foreyt et al. 2009, Adler 2010, McAllister 2014). Not all of these pathogens have documented detections in Montana predator populations. However, since these pathogens are known to circulate in predator populations outside of Montana, it is possible that some pathogens may be undetected in Montana predator populations or may be introduced to those populations in the future. Predator management can have an indirect effect by reducing the risk of livestock contracting a disease by minimizing the potential for livestock-predator interactions. WS-Montana has not been requested to conduct IPDM specifically for livestock disease control, but IPDM activities for other reasons can indirectly assist disease control efforts when carcasses are sampled.

1.11.3 What is the Need for IPDM in Montana for Protecting Agriculture Resources and Property Other Than Livestock?

1.11.3.1 Background

As discussed previously, predators within the scope of this EA in Montana cause conflicts with livestock, comprising 95% of WS-Montana's responses to conflicts (based on Work Tasks recorded; Section 1.11.2.7). The remaining 5% of responses were for other conflicts with predators including conflicts with other agricultural resources (trees, seedlings, and pen-raised game animals), other animals (pets and guard animals) , other property damage, aircraft damage (Section 1.12.4.9), and human health and safety. Property damage is typically caused by grizzly bears, black bears, coyotes, feral/free-roaming dogs, foxes, badgers, skunks, ravens, and raccoons. Predators such as foxes and badgers can burrow in improved or planted pasture, inhibiting the use of planting and mowing equipment and damaging the equipment. Predators also damage buildings and structures (including homes, sheds, barns, coops, etc.), trying to gain access for food or other resources, and undermining the structure's foundation. Bears, coyotes, skunks, and badgers damage irrigation pipe systems. These and other predators burrow into dikes and dams, damaging barriers and liners. Skunks, raccoons, and coyotes destroy gardens, lawns, or turf farms, and they live under homes, destroying insulation and other components and creating health concerns with feces. Damage to agricultural resources can be caused by multiple species. Tree and seedling damage is caused by coyotes. Hives in bee yards, grain storage bins, and corn fields are damaged by black bears and grizzly bears, which are attracted to the high calorie food source. Reported and verified damage recorded by WS-Montana for these types of agricultural resources and property totaled $170,643 for FY2013 through FY2017, an average of $34,129 per year (MIS 2018).

While feral swine have not been confirmed in Montana, abundant feral swine in Saskatchewan, Canada are likely to disperse into Montana (Brook and van Beest 2014). The damage from feral swine to natural and agricultural resources can be substantial (Seward et al. 2004). Pimentel (2007) estimated damage caused by feral swine could be $300/animal/year.

1.11.3.2 What Actions Does MFWP Take to Address Property Damage Caused by Bears?

MFWP continues to work with landowners to address issues related to property damage caused by grizzly bears and black bears including lethal and non-lethal options and to provide non-lethal recommendations to agricultural operators and property owners on ways to reduce or eliminate damage from depredating bears (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).

The department provides advice and education to the general public to attempt to resolve conflicts with bears, first through simple precautions in as many instances as possible (Dood et al. 2006, Montana Fish Wildlife and Parks 2013). Property damage by bears may be eliminated or mitigated by various means depending on the type of damage. Noise repellents, hazing, and electric fencing may be effective methods to reduce damage depending on specific situations. Because bears are sensitive to electricity, electric fences may eliminate bear damage to beehives, orchards, livestock, domestic fowl, or other property. However, electric fences may be difficult and costly to install and maintain, or may be prohibited by local ordinances, particularly in residential areas. For example in Bozeman, city ordinances prohibit electric fences because they are viewed as a hazard to human safety. Bears are strong, agile climbers, and as a result, other types of fences may be ineffective at preventing damage from bears.

For black bears, MFWP has the following guidelines for responding to reported black bear property damage (MFWP 2003):

MFWP response to a black bear observed in a property damage situation or determining to be habituated to humans:

- Capture, relocate or destroy the bear depending upon the circumstances of each individual bear incident.
- Advise the reporting party of appropriate preventive actions that should be taken.
- Following a warning and reasonable opportunity to comply, issue a warning or citation (MCA 87-3-130(2)(a) and (b)) to persons who purposely or knowingly attract bears with supplemental feed attractants or, after receiving a previous warning, fail to properly store supplemental feed attractants to allow bears access to the supplemental feed attractants.
- When an employee is unable to respond immediately, the person receiving the call should advise the caller to contact the nearest public safety agency, if the situation worsens.
- Continual presence of a bear may require aversive conditioning or capture.

Under MCA 87-3-127, a landowner or landowner agent (private or WS-Montana or MFWP) is allowed to use lethal control including pursuit with dogs to address damage to livestock including beehives caused by black bears without obtaining a permit from the MFWP. Complaints about black bears causing damage are often addressed by landowners, landowner agents, or the WS-Montana field specialist in participating counties and at the discretion of the landowner. The presence of a WS-Montana field specialist in any given county is dependent on that county providing partial financial support for a full- or part-time agent. These agents assist producers with advice or lethal control to address issues related to damage by bears and other wildlife species.

For grizzly bears, MFWP has the following preferred management approaches to manage property damage by grizzlies (Dood et al. 2006, Montana Fish Wildlife and Parks 2013):

- Focus on preventive measures, including securing attractants, and improving overall sanitation; the agency's bear management specialist works on these issues on public and private lands.
- Seek funding to continue the grizzly bear management specialist positions currently stationed in Missoula, Kalispell, and Choteau.
- Respond to conflicts as soon as feasible by phone or in person if possible.

According to MFWP grizzly bear management plans (Dood 2006, MFWP 2013), techniques to prevent damage may include aversive conditioning, physical protection (i.e., electric fencing), relocating or removing offending animals, and deterrent devices.

MFWP will continue to encourage the development of effective non-lethal damage management techniques and equipment. MFWP will cooperate with city, county, state, tribal and federal governments to develop model systems for managing attractants, provide incentives for property attractant management, and pursue the establishment of penalties that result in compliance with attractant storage regulations (*e.g.* MCA §87-3-103 and §87-6-216).

Variations in predator complaint volumes over time may actually reflect annual changes in food availability rather than population abundance (e.g., (Howe et al. 2010)), landscape characteristics and land-use changes (e.g., (Merkle et al. 2011), or regulatory changes (e.g., (Howe et al. 2010). However, as bear and human abundance and distribution increase, an increase in the level of conflicts may be expected (Garshelis and Hristienko 2006). In Montana, changes in the number of complaints vary geographically. For example, in NW Montana there have been years with low mast production and increased numbers of complaints, but east of the Rocky Mountain Front, increased numbers of complaints are caused by an expanding grizzly bear population.

1.11.4 What is the Need in Montana for Protection of Public Safety, Health, and Pets from Predators?

1.11.4.1 What is the Potential for Risk to Human and Pet Health and Safety from Predators?

An increasing potential for contact between humans, domestic animals and wildlife occurs as people make greater use of wildlife habitat for a variety of recreational and commercial pursuits, and as wildlife enters human-occupied areas in pursuit of food and other resources. Habitat alterations that may increase conflicts include the planting of ornamental plants and vegetables, artificial pools, pets, pet food, garbage, piles of waste debris and woodpiles. Many people enjoy wildlife to the point of purchasing food specifically for feeding wildlife despite laws prohibiting this in Montana. MCA §87-6-216 stipulates that providing supplemental feed for the purpose of attracting game animals, such as bears or mountain lions, is unlawful. The constant presence of human-created refuse, readily available water supplies, and abundant prey populations found in areas of human development can potentially increase the attractiveness of those communities to predators.

Many animals have become food conditioned or habituated to people, vehicles, and developed areas and may exhibit bold or threatening behavior toward humans. In addition to food conditioning and habituation, disease may also cause these behaviors. Wildlife attacks on humans are rare in Montana and nationwide. However, in order to manage these rare threats, MCA §87-1-217 calls for MFWP to include the safeguarding of humans, livestock, and pets as primary goals.

WS-Montana conducts limited IPDM actions in Montana to protect human and pet health and safety, when requested. Although rare, these concerns include: attacks on humans and pets by mountain lions, bears, wolves, and coyotes that result in injuries or death; disease threats from rabies and plague; odor and noise nuisances from skunks and raccoons under houses; and airstrike hazards from ravens, red foxes, skunks, and coyotes utilizing aircraft operating spaces. The number of predators causing threats to HHS in

Montana annually, with the exception of those representing airstrike hazards, are shown in Table 1.11.

Table 1.11. Predators reported to WS-Montana presenting non-aviation related threats human and pet health and safety (FY2013-FY2017).

Fiscal Year	Black Bears	Grizzly Bears	Mountain Lions	Bobcats	Coyotes	Red Foxes	Common Ravens	Striped Skunks
2013	1	5	3	1	2	1	0	0
2014	1	1	5	0	6	0	1	0
2015	1	2	5	0	1	0	0	0
2016	1	2	1	0	0	0	0	0
2017	2	2	5	0	1	0	0	1
Total	6	12	19	1	10	1	1	1

1.11.4.2 What is the Extent of Human-Coyote Interactions?

Timm et al. (2004). Reported attacks occur frequently in areas of wildland-suburban interface where coyotes are drawn to readily available resources such as pets, pet food, rabbits, rodents and water, or due to reductions in predator management programs (Timm et al. 2004). Purposeful feeding of coyotes in some locations appears to increase coyote habituation which can also lead to conflict (Timm and Baker 2007).

Recent and highly publicized coyote attacks have heightened people's awareness of the potential threat of such encounters. In the Chicago metropolitan area, newspaper articles related to human-coyote conflicts increased over twenty-fold since the 1990s (White and Gehrt 2009). In July 2015, four coyote attacks on children were reported in Irvine, California within a month (Heck 2015), (California Department of Fish and Game 2015). While bites or deaths caused by coyotes are generally reported by the media as 'attacks', White and Gehrt (2009) found that some reports of coyote scratches or neighborhood sightings have been reported as 'attacks.'

In addition to threats to human health and safety, during FY2013-FY2017, WS-Montana responded to 45 conflicts where pets were the reported resource at risk, of which 27% were related to coyotes, 27% to mountain lions, 40% to gray wolves, and 7% to grizzly bears (MIS 2018).

When non-lethal methods are not effective or human health and safety is at imminent risk, lethal methods may be needed. Coyotes are defined in the State of Montana as predatory animals (MCA §87-2-101) and hunting is not regulated by federal or state laws or regulations. However, methods for lethal take may be limited in urban areas pursuant to local ordinances. MFWP, MDOL, and WS-Montana have authority to lethally remove coyotes within county and city limits (MCA §81-7-101-102).

1.11.4.3 What is the Extent of Human-Bear Interactions?

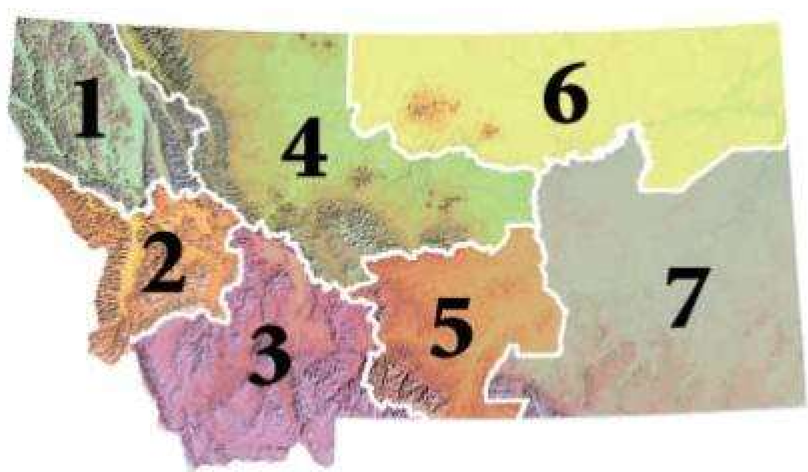
During 1900-2009, at least 63 people were killed during 59 incidents involving non-captive black bears in North America (Herrero et al. 2011). During 1992-2000, 995 human-grizzly bear conflicts, 35 of which involved injury to humans, were reported in the Greater Yellowstone Ecosystem with no significant increase in frequency over time (Gunther et al. 2004). However, Penteriani et al. (2016) reports the number of grizzly bear attacks in North America has been increasing since 1985 (Penteriani et al. 2016) with 7 fatalities occurring in the Northern Rockies since 2010 of which 6 occurred in the greater Yellowstone area (Yinn 2016).

According to Montana's Environmental Quality Council's (EQC) program evaluation wildlife conflict management by MFWP (referred to as DFWP below; EQC 2015):

> "In the last 10 years, the DFWP's Region 1, based in Kalispell, recorded seven incidents involving bears (three involving grizzlies) in which seven people were injured and an eighth was killed. Region 4, headquartered in Great Falls, recorded four grizzly bear/human interactions in which one person was injured."

In 2018, MFWP requested WS-Montana assistance to capture a grizzly bear that mauled a bird hunter in Region 4.

Figure 1.2. Map of MFWP regions.



Although large carnivore attacks on humans are rare compared to human fatalities by other wildlife, the increase in large carnivore populations and the increasing number of people involved in outdoor activities increases the probability of risky encounters and potential attacks (Penteriani et al. 2016).

MFWP is responsible for responding to situations where black bears or grizzly bears are considered dangerous to people and has entered into an MOU with WS-Montana for receiving assistance where necessary (Section 1.8). Between FY2013 and FY2017, WS-Montana responded to 7 human safety issues for black bears and 13 for grizzly bears, while for grizzly bears WS-Montana received an annual average of 68 complaints related to grizzly bear damage. Over the same time period, MFWP relocated 273 black bears and 41 grizzly bears in response to human conflicts (Table 1.12; https://fwp.mt.gov/conservation/wildlife-management).

1.11.4.4 What are MFWP's Objectives and Strategies Related to Bear-Human and Pet Health and Safety Management?

The MFWP's objectives for managing bears that are a threat to human/pet health or safety involve working to reduce the number of human-bear conflicts that may result in the lethal or non-lethal removal of the bear, particularly in situations where bears may become habituated to humans, as well as maintaining healthy and optimum bear populations (U.S. Fish and Wildlife Service 1993, Dood et al. 2006, U.S. Fish and Wildlife Service 2012, Montana Fish Wildlife and Parks 2013). Policies differ depending on the nature of the conflict and the bear species in conflict (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).

There are two management plans for grizzly bears, listed as threatened under ESA, in Montana (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).

MFWP's direction regarding the management of grizzly bear conflicts in western Montana in the areas surrounding Glacier National Park includes the following from Dood et al. (2006):

- "Bears that kill people in either an unprovoked or provoked situation will be removed from the population if they can be reasonably identified. If a female with cubs at side attacks and kills a person in an unprovoked situation, removal of the cubs from the population will be considered to prevent a learned behavior from being passed along. In this instance, MFWP recognizes that the approach is more constrained than present guidelines."
- "Bears displaying unacceptable aggression, or behavioral responses considered to be a threat to human safety, will be removed from the population as quickly as possible."

  Bears may become habituated to human activities (ignore nearby human activity) or become "food conditioned" (consume human food or garbage or other attractants). While food conditioned bears do not necessarily become habituated, habituated bears often lose their fear of humans and consequently no longer avoid people. More importantly, habituated and/or food-conditioned bears are often involved in injury or death to humans.

  "To deal with these issues, MFWP preferred approaches are as follows:

  • If the bear is already habituated and/or food conditioned and is viewed as a threat to human safety, that bear would be removed (euthanized or relocated to a research facility/zoo).
  • Any bear causing human injury or death while acting in a predaceous manner, will be destroyed as will any cubs at side accompanying a female.
  • A bear displaying aggressive, but non-predaceous, behavior will not necessarily be removed, depending on the circumstances of the encounter and the sex, age and reproductive status of the bear."

MFWP's direction regarding the management of grizzly bear conflicts in southwest Montana in the areas surrounding Yellowstone National Park includes the following (Montana Fish Wildlife and Parks 2013):

> • Lethally remove bears displaying predatory behavior that kill/injure/attack people.
> • Consider lethal removal for bears that kill/injure/attack people in a surprise encounter situation on a case by case basis.
> • Consider lethal removal for bears displaying bold, aggressive behavior resulting in a threat to human safety on a case by case basis.
> • Consider preemptively relocating a grizzly bear to avoid conflicts when there is a demonstrated threat to human safety.
> • Attempt to remove any grizzly bear displaying unnatural aggression or considered a threat to human safety, as quickly as possible.
> • Attempt to remove any grizzly bear displaying natural defensive behavior when, in the judgment of FWP, circumstances warrant removal and non-lethal methods are not feasible or practical.
> • Aversively condition, relocate, or remove any grizzly bear displaying food-conditioned, or habituated behaviors, or damaging property based on the individual bear and specific details of the incident. Management authorities will make these decisions after considering the cause, location, and severity of the incident or incidents.
> • Preemptively move a grizzly bear when it is in an area where it is likely to come into conflict with humans or their property. Conversely, temporarily exclude people from an area if the situation has a high risk to the public, e.g. a carcass on a trail being fed on by grizzlies."

MFWP guidelines for dealing with back bear incidents classify incidents into 4 categories: 1) bear that cause a human injury or is determined by MFWP to pose an immediate threat to human safety; 2) bear that causes property damage, was previously captured and relocated and reappears as a nuisance bear, or is determined to be habituated to humans, human foods, garbage, structures or equipment; 3) bear sighted in or near human habitation; and 4) bear involved in livestock depredation, including beehives (Montana Fish Wildlife and Parks 2013). The guidelines found in Montana Fish Wildlife and Parks (2013) list incident response procedures by category all of which include notification procedures. The response procedures for black bears causing property damage or that are habituated to humans are reviewed in section 1.11.3.2. For black bears that pose an immediate threat to human safety, responses are: 1) notify the appropriate emergency response entity as possible; 2) MFWP will notify the nearest available MFWP biologist and warden and/or law enforcement agency for dispatch to the case; 3) a description of the incident and all actions taken by MFWP personnel will be documented; and 4) when possible, all black bears posing an immediate threat to human safety will be immediately destroyed as safely and humanely as possible (Montana Fish Wildlife and Parks 2013).

Characteristics of residential areas often limit the ability to capture and remove bears that are a safety threat, nuisance, or causing damage. The presence of pets, children, and private properties make some methods used to capture or haze bears impractical.

Discharging a firearm or other weapon is usually prohibited by law within city limits or by ordinance within residential areas. As a result, most conflicts in residential areas are resolved through advice from the department and actions taken by affected homeowners. All MFWP bear management guidelines include strategies to educate the public about safety measures to prevent conflicts with bears and develop and enforce practical and effective attractant storage rules/regulations (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).

In situations related to human safety or considerable damage within residential areas, culvert traps may be used by MFWP in an attempt to capture the bear causing problems. Culvert traps or box-type traps are safe for use in areas where pets and people may frequent. However, the capture efficiency of these traps is limited, especially if food is readily available, so, in some circumstances, problem bears cannot be removed and residents must become educated on how to reduce or prevent the problems. Table 1.12 summarizes relocations of grizzly bears and black bears by MFWP between 2013 and 2017.

Table 1.12. Bears Relocated by MFWP for conflicts with humans 2013-2017 (Montana Fish Wildlife and Parks 2020).

Species Relocated	2013	2014	2015	2016	2017	Total
Black Bears	24	29	112	15	17	197
Grizzly Bears	7	3	6	9	13	38
Total	31	32	118	24	30	235

MCA §87-6-106 states that there is no criminal liability for taking of wildlife, with the exception of grizzly bears, that is attacking, killing, or threatening to kill a person or livestock. Grizzly bears may only be taken if they are attacking, killing, or threatening to kill a person or if the grizzly bear is in the act of attacking or killing livestock. All take under this provision must be reported to MFWP within 72 hours (MCA §87-6-106). The exception to this state law comes from federal regulations regarding grizzly bear take. Take is managed according to the guidelines set in the original listing (40 CFR 31734, July 28, 1975), which states, "Grizzly bears in the 48 conterminous States may not be taken except in defense of human life, or to remove demonstrable but non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises... In addition, takings to remove demonstrable but non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises, can be performed only by Federal or State employees, and only after reasonable efforts to live-capture and release unharmed in a remote area the bear involved have failed."

1.11.4.5 What is the Extent of Human-Mountain Lion Interactions?

Potentially dangerous mountain lion behaviors relative to human health and safety include aggressive actions such as charging or snarling, or loss of wariness of humans. Although rare, mountain lion attacks on humans in the western United States and British

Columbia have increased (Beier 1992), (Cougar Management Guidelines Working Group 2005, Penteriani et al. 2016), primarily due to increased mountain lion populations, reduced hunting, and increased human use of mountain lion habitat (Beier 1992),). For example, since California's Wildlife Protection Act of 1990 gave mountain lions special status in the state resulting in a prohibition on regulated hunting, there were three fatal attacks and twelve non-fatal attacks in California during 1986 through January of 2014 (California Department of Fish and Game 2017). Fitzhugh et al. (2003) report there were 16 fatal and 92 non-fatal attacks on humans since 1890 in the United States and Canada. Of those attacks, seven fatal and 38 non-fatal attacks have occurred since 1991.

The last fatal attack in Montana, of a 5-year-old boy, occurred in 1989. Since then 3 attacks, all on children, have been documented (Milliard 2008). In 2018, MFWP requested WS-Montana to assist with the removal of a mountain lion that was stalking bicyclists on BLM trails near Red Lodge.

According to Montana's EQC evaluation of wildlife conflict management by MFWP (referred to below as DFWP)(Stockwell 2015):

> "The number of mountain lion complaints in Region 2 averaged about 250 annually in the last 4 years. The DFWP says the number of complaints correlates directly to the availability of deer, elk, and turkeys inhabiting the area. In 2012, 77% of the complaints involved mountain lions seeking out natural prey species in and around home sites within riparian and foothill regions. Four percent of calls in 2012 involved humans encountering mountain lions at close range."

Between FY2013 and FY2017, WS-Montana responded to 21 human health and safety related requests involving mountain lions. Over the same time period MFWP did not relocate any mountain lions (http://fwp.mt.gov/).

1.11.4.6 What are MFWP and WS-Montana Responses to Mountain Lion Threats?

MFWP has developed standardized guidelines for responding to mountain lion sightings and damage complaints (Montana Fish Wildlife and Parks 2019b). In instances of livestock depredation, Wildlife Services-Montana is notified, and assistance given as needed. Montana law (MCA §87-3-127) gives stock growers the right to kill certain stock-killing predator species, including mountain lions.

1.11.4.7 What is the Extent of Human-Wolf Interactions?

Wolf attacks on people are very rare. Most wolf incidents occur when wolves habituate to humans or human activities and exhibit bold behaviors which at times have included exploring campsites and stealing gear or food (Boyd 2017). Prompt management ensures that habituation does not result in threats to human safety. The expanding distribution of both wolves and humans has led to an increase in wolf-human encounters in the last 30 years (Boyd 2017). Two documented fatal attacks by wolves on humans have occurred in North America in recent years. The first occurred in November 2005 near Points North, Saskatchewan (McNay 2007) and the other in March 2010 near the village of Chignik Lake, Alaska (Butler et al. 2011). In the first case, evidence suggested several local wolves had become habituated to people, and the victim was attacked while out walking alone in a wooded area. Those wolves had been feeding on the victim's body before searchers found the remains, indicating the attack was likely predatory. This is believed to be the first documented human mortality from wolves in North America. In the second case, Alaska officials concluded wolves killed a 32-year-old woman as she was jogging along a gravel road near the Town of Chignik Lake, on the Alaska Peninsula (Butler et al. 2011). Wolves have not attacked and injured or killed any people in the lower 48 United States. However, McNay (2002) reviewed 80 wolf-human encounters in Alaska and Canada and found that an increase in aggressive wolf-human encounters after 1970 occurred a minimally exploited wolf population converged with human activity in wolf habitat.

In Montana, wolves have injured and killed domestic pets, primarily dogs associated with livestock operations (Montana Fish Wildlife and Parks 2003). Bangs and Shivik (2001) note wolves probably perceived hunting hounds and guarding/herding dogs as "trespassing" competitors rather than prey because wolves did not feed on the domestic dogs. When wolves approach human residences and threaten or kill people's pets or exhibit bold behavior, people often become concerned for human safety. This is especially true if small children are present at those residences. WS-Montana responded to one request for assistance with wolves involving human safety between FY2013 and FY2017 while receiving an average of 103 complaints related to wolf damage each year.

1.11.4.8 What are MFWP and WS-Montana Responses to Wolf Threats?

The wolf population in Montana has been at or above the biological criteria for recovery since 2004. Rapid population growth occurred between 2004 and 2011. In 2011 after wolves were delisted, MFWP implemented the state's management framework which included an adaptive management strategy (Montana Fish Wildlife and Parks 2003). This adaptive strategy allows for more liberal management of wolves when the wolf population is above the population goals of 15 breeding pairs and 150 wolves. Wolves in Montana have remained well above these goals since delisting (Boyd et al. 2017).

The MOU between WS-Montana and MFWP outlines responsibilities for WS-Montana and MFWP. For wolf damage management, WS-Montana is responsible for responding to livestock depredations suspected of being caused by wolves. MFWP is responsible for responding to non-livestock complaints. The MOU authorizes WS-Montana to harass wolves or otherwise non-lethally intervene if wolves are observed in the vicinity of livestock or if they present a threat to livestock. The MOU also states that WS-Montana and MFWP agree to cooperatively disseminate information and coordinate efforts to prevent depredation at sites where prevention measures can be implemented. When livestock losses cannot be prevented, field responses will be directed at offending animals with responses to occur as closely in time and space to the site of the damage as practical. In instances where traps or snares are set, they will be checked every 24 hours. The MOU also states that MFWP and WS-Montana will collaborate and share information during the preparation of an Interagency Wolf Program Annual Report on management actions that occurred during the calendar year. The MOU reiterates the guidance for wolf damage management provided in the 2012 Montana protocol to address wolf-livestock conflicts.

In 2012 MFWP released a protocol that outlines criteria for wolf damage management such that a response to a problem involving wolves is implemented closely in time and space to where the damage occurred. This protocol is designed to enact the state's adaptive management framework contained in the state's conservation and management plan (Montana Fish Wildlife and Parks 2003) while meeting all of the objectives in that plan including maintaining a viable and connected wolf population in Montana. When the wolf population is greater than 15 breeding pairs, this protocol authorizes WS-Montana to identify, target, and remove offending wolves for 45 days after livestock depredation is confirmed as a wolf kill. During this 45 day period, WS-Montana may use all methods available: foot-hold traps, neck snares, shooting, calling, and aerial shooting. This protocol states that WS-Montana "shall make every effort to avoid lethal removal of non-problem wolves in areas near and adjacent to the site of depredation." This protocol also outlines expectations for regular communication with MFWP including contacting MFWP within 24 hours of initiation of control or collaring efforts and notifying the appropriate MFWP wolf specialist within 48 hours of any wolves being collared or removed. When WS determines a depredation event to be a "probable" wolf-related loss (the presences of some evidence suggests possible predation but there is a lack of sufficient evidence to clearly confirm predation by a particular species) and there are greater than 15 breeding pairs, WS may immediately attempt to collar and then contact MFWP as soon as possible. Lethal control is not automatically permitted for probable wolf damage. When the wolf population is less than 15 breeding pairs, which has not occurred since this protocol was implemented in 2012, more conservative levels of lethal control are to be implemented. In this case, WS may put out traps at or near the depredation site during an investigation. WS-Montana is expected to contact MFWP as soon as possible with the outcome of the investigation. MFWP would then authorize implementation of lethal control or request that a radio collar be placed in the pack.

1.11.4.9 What is MFWP's Policy Regarding Relocation of Offending Bears and Mountain Lions?

MFWP does not relocate coyotes and wolves that come in conflict with humans because of the healthy size of the populations statewide and the high risk of moving the problem along with the animal. These MFWP policies avoid causing damage problems in the receiving site, reduce the risk that the animal will return to its original home range, and avoid potentially causing the death of the animal due to occupied territories or unfamiliarity with the new location. MFWP may relocate black bears, grizzly bears, and mountain lions as an attempt to resolve human-wildlife conflicts (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).

Release locations are made publicly available within a week of relocation at https://fwp.mt.gov/conservation/wildlife-management. Species specific relocation policies can be found in Sections 1.11.3.2, 1.11.4.4, and 1.11.4.6.

1.11.4.10 What is the Potential for Disease Transmission to Humans and Pets?

Diseases of wildlife, livestock, pets, and humans can be caused by viral, bacterial, or parasitic pathogen species. Zoonoses (i.e., diseases transmissible to people) are a major concern for wildlife managers and other. Pathogen transmission occurs through direct contact between infected and uninfected hosts, including host contact with a pathogen-contaminated environment or food product. Indirect transmission of pathogens through an intermediate host or vector species, such as biting insects, is another possible transmission pathway. Once a pathogen is established, secondary cases of infection in other herd members or humans can occur. Pets and livestock often encounter and interact with wild mammals, which can increase the opportunity of transmission of pathogens to humans. WS-Montana uses technical assistance to actively attempt to educate the public about the risks associated with pathogen transmission from wildlife to humans and pets.

The transmission of pathogens from wildlife to humans can be complicated by the potential for numerous species to act as reservoirs and sources of infection. Unless otherwise noted, the pathogens listed in this section are not currently monitored in predator populations by WS-Montana and may go undetected or may be introduced to these populations in the future. While these zoonoses are known to circulate in predator populations outside of Montana, not all of these have been confirmed in Montana predator populations. WS-Montana currently conducts minor amounts sampling for diseases that can be transmitted to humans and pets in Montana as part of the WS-National Wildlife Disease Program. However, WS-Montana remains available to assist MFWP or the Department of Public Health with active or passive sampling, as requested.

Individuals or property owners that request assistance frequently have the perception of potential disease risks from animals living in close proximity to people, from animals uncharacteristically roving in the daytime in residential areas, or from animals exhibiting a lack of fear of humans. The most common disease concern is the threat of rabies transmission to people, pets, and companion animals. Rabies is an acute, fatal viral disease of mammals most-often transmitted through the bite of a rabid animal. Rabies poses a threat to humans, either indirectly from exposure from pets or livestock that have been infected, or directly from handling or from being bitten by an infected animal. Rabid animals are often aggressive, with a tendency to bite, but may also appear to be overly docile. In Montana, the occurrence of rabies is rare, with bats being the more common species causing transmission. See http://liv.mt.gov/Animal-Health/Diseases/Rabies. Pets can be vaccinated against rabies and, if a human is exposed, rapid and early treatment is typically effective.

Thanks to aggressive domestic animal vaccination campaigns in the U.S., wild, rather than domestic, animal cases have comprised the majority of cases reported annually by the U.S. Centers for Disease Control and Prevention since 1960. Infected wildlife have been primarily terrestrial carnivores and bats (Krebs et al. 2000) (Centers for Disease Control and Prevention 2011). The number of rabies-related human deaths in the United States has declined from more than 100 annually in the early 1900s to an average of one or two people per year in the 1990s (U.S. Centers for Disease Control and Prevention 2017). However, the costs associated with treatment can be between $1,000 and $3,000 or more (Centers for Disease Control and Prevention 2011). In addition, the number of pets and livestock examined and vaccinated for rabies, the number of diagnostic tests requested, and the number of post-exposure treatments can be expensive. Overall, costs assisted with living with rabies in the U.S. in 2019 are estimated at $675 million USD

(Fishbein and Arcangeli 1987, U.S. Centers for Disease Control and Prevention 2017, CoinNews.net 2018)

Feral swine can carry 30 viral and bacterial diseases, and nearly 40 parasites that may affect humans, pets, domestic livestock, and wildlife species (Ruiz-Fons et al. 2007, Meng et al. 2009). Feral swine can also harbor the causative agents of important foodborne diseases such as *Escherichia coli* (*E. coli*), *Salmonella spp.* and *Trichinella spira*lis (Brown et al. 2018). Additionally, feral swine can transmit many of these diseases to pets, including pseudorabies. Dogs, particularly hunting dogs, become infected with pseudorabies after coming into contact with infected feral swine. Once a dog is infected, there is no treatment, and death typically occurs 48–72 hours after symptoms appear (State of Hawaii 2019).

Parvovirus is a common infectious domestic canine disease in the U.S. with a high morbidity and mortality rate in unvaccinated and untreated dogs. Coyotes, foxes, gray wolves, raccoons, feral cats and dogs, and other wildlife can carry the highly infectious parvovirus, after coming in contact with infected animals or contaminated feces. Puppies and incompletely vaccinated dogs are the most at risk of infection, and affected puppies have the highest mortality rate (Nandi and Kumar 2010, Decaro and Buonavoglia 2011, Mitchell 2016). Wildlife can serve as a reservoir for the disease. When shed in feces, the virus is environmentally stable and extremely difficult to destroy.

Leptospirosis bacteria, carried by striped skunks, raccoons, feral swine, and red fox, can infect humans and pets (Meng et al. 2009). Transmission usually occurs by direct contact with urine-contaminated water or food (Adler 2010). Pets are commonly infected when wildlife have access to water bowls or when they drink from streams. People living or working closely with animals, wild or domestic, have a higher risk of developing leptospirosis (World Health Organization 2019). Currently, WS-Montana is collecting blood samples as part of a nationwide research program conducted by the National Wildlife Research Center to determine the distribution and prevalence of *Leptospira* infection in canines and raccoons.

Raccoon roundworm, *Baylisascaris procyonis*, are common parasites of raccoons. While the parasite causes little or no clinical disease in those natural host species, it can cause serious or fatal disease in humans and domestic animals. Raccoon roundworm is transmitted through eggs shed in feces. When raccoons use human structures for shelter, feces can build up in attics, roofs, and yards, increasing the odds that human will come in contact with infected soil or feces. Children are at increased risk of contracting the parasites by putting contaminated fingers, soil, or objects in their mouths. Human fatalities have been confirmed in the U.S. when the mature roundworm migrates to the brain. The roundworm can also migrate to the central nervous system and eyes. There is no test for roundworm infection, and medical professionals believe it may be an underrepresented cause of death (Centers for Disease Control and Prevention 2002).

Mange, caused by a sarcoptic mite, infects foxes, coyotes, and wolves in the Rocky Mountains (Jimenez et al. 2010), causing fur loss and thickened crusting on the skin. Mange is transmitted to other animals and to humans by direct contact or contact with blankets and other bedding, giving humans a red, itchy rash.

Echinococcosis infections (Hydatid disease) involve the larval stage of tapeworm that depends on wild ungulates and fox, coyote, and wolves for transmission, but can infect any animal (Foreyt et al. 2009). Tapeworm cysts can be found in the liver, other organs, nervous tissue, or bone. People become infected by accidentally ingesting the eggs when handling infected animals or by eating contaminated food, water, or soil. If not treated, it is potentially fatal (Montana Fish Wildlife and Parks 2010).

Several pathogens infectious to people have been found in feral cats and dogs, including ringworm (*Tinea* spp.,), a contagious fungal disease contracted through direct interactions with an infected person, animal, or soil; pasteurella; salmonella; Bartonella (cat scratch disease); and numerous parasites including roundworms; tapeworms; and toxoplasma. Pregnant women, children, and people with weakened immune systems are at increased risk of clinical disease if exposed to toxoplasma (American Veterinary Medical Association 2004). In 1994, five Florida children were hospitalized with encephalitis that was associated with cat scratch fever (American Veterinary Medical Association 2004). The daycare center at the University of Hawaii at Manoa was closed for two weeks in 2002 because of concerns about potential transmission of murine typhus (*Rickettsia typhi)* and flea (*Ctenocephalides felis*) infestations. The fleas at the facility originated from a feral cat colony that had grown from 100 cats to over 1,000 cats, despite a trap, neuter, and release effort (American Veterinary Medical Association 2004).

Domestic and feral cats are also vectors of toxoplasmosis, through birds, and rodents and other mammals, which can infect humans and other wildlife through contact with cat feces and oocysts in the soil (Torrey and Yolken 2013). The oocysts can also enter water supplies, and persist in soil for up to 18 months (Dumetre and Darde 2003). Toxoplasmosis can be transmitted to humans and cause miscarriages, still-births, microcephaly, mental retardation, and blindness. Although cats are only infected once before gaining immunity, the huge number of outdoor cats in the U.S. is sufficient to maintain a large volume of oocysts in the environment. Reducing the number of feral and free-ranging cats is an important step in prevention, according tort The Wildlife Society (http://wildlife.org/wp-content/uploads/2014/05/28-Feral-Free-Ranging-Cats.pdf).

Cats can also transmit the rabies virus, plague and other diseases. Both plague and tularemia can cause severe disease in humans. WS-Montana is participating in the National Surveillance Plan by collecting blood samples from mammals, including predator species.

1.11.4.11 What Work is Needed to Protect Air Operations from Predators at Montana Airports?

Airports provide ideal conditions for many wildlife species due to the large open grassy areas often adjacent to brushy, forested habitat used as noise barriers, these are also often adjacent to water. Access to most airport properties is restricted, so predators living within airport boundaries are not harvestable during hunting and trapping seasons and are insulated from many other human disturbances.

The civil and military aviation communities have acknowledged that the threat to human health and safety from aircraft collisions with wildlife is increasing (Dolbeer et al. 2000, MacKinnon et al. 2004, Dolbeer 2009). Collisions between aircraft and wildlife are a concern throughout the world because wildlife strikes threaten passenger safety (Thorpe 1996), result in lost revenue, and repairs to aircraft can be costly (Linnell et al. 1996, Robinson 1996, Thorpe 1998, Keirn et al. 2010). Aircraft collisions with wildlife can also erode public confidence in the air transport industry as a whole (Conover et al. 1995).

Between 1990 and 2014, there were 3,360 reported aircraft strikes involving 41 species of terrestrial mammals in the United States (Dolbeer et al. 2015) . The number of mammal strikes actually occurring is likely to be greater even though strike reporting at General Aviation airports has increased 58% from 2010 to 2014. Species of terrestrial mammals struck by aircraft in the United States from 1990 through 2014 include raccoons, fox, cats, coyotes, deer, opossums, dogs, and skunks (Dolbeer et al. 2014). Of the reports of terrestrial mammals struck by aircraft, 36% were carnivores (primarily coyotes), causing over $4 million in damages (Dolbeer et al. 2014). Aircraft striking coyotes have resulted in 14,135 hours of aircraft downtime and nearly $3.7 million in damages to aircraft in the United States since 1990 (Dolbeer et al. 2014). Aircraft strikes involving dogs have caused over $400,700 in damage in the United States since 1990 (Dolbeer et al. 2014).'

In addition to direct damage, an aircraft striking a mammal can pose serious threats to human safety if the damage from the strike causes a catastrophic failure of the aircraft leading to a crash. For example, damage to the landing gear during the landing roll and/or takeoff run can cause a loss of control of the aircraft, causing additional damage to the aircraft and increasing the threat to human safety. Nearly 64% of the reported mammal strikes from 1990 through 2014 occurred at night, with 89% occurring during the landing roll or the takeoff run (Dolbeer et al. 2014).

From 1990 to 2016, of the species included in this EA, civil aircraft have been reported striking one coyote, one domestic dog, and one red fox in Montana (Federal Aviation Administration 2015). Since October 1, 2008, 14 airports in Montana have requested assistance with managing threats to human safety and damage to property associated with predators present inside the area of operations of airports and receiving training in addressing their problems. The infrequency of aircraft strikes does not lessen the need to prevent threats to human safety and the prevention of damage to property. Preventing damage and reducing threats to human safety is the goal of those cooperators requesting assistance at airports in Montana given that a potential strike could lead to the loss of human life and considerable damage to property.

Wildlife confined inside an airport perimeter fence are not considered distinct populations nor separate from those populations found outside the perimeter fence. Wildlife found within the boundaries of perimeter fences originate from populations outside the fence. Those individuals of a species inside the fence neither exhibit nor have unique characteristics from those individuals of the same species that occur outside the fence; therefore, those individuals of a species confined inside an airport perimeter fence do not warrant consideration as a unique population under this analysis.

WS-Montana provides part-time assistance to airports in Montana. For predator species considered in this EA, WS-Montana provided responses to conflicts at 6 airports. These included red foxes (nearly 23%), coyotes (18%), striped skunks (7%), ravens (32%) and badgers (7%). Other species included in this EA accounted for no more than 1 between FY2013 and FY2017.

1.11.5 What is the Need for WS-Montana Assistance with Disease Surveillance?

The Montana wildlife disease program provides WS-Montana and cooperators with valuable information on what wildlife species are being exposed to what pathogens and an index on the level of exposure. Additionally, WS-Montana's disease program allows for better communication and collaboration with our partners and quicker response time to potential disease outbreaks due to trained personnel solely dedicated to wildlife disease issues.

Detecting changes in the wildlife species exposed to pathogens and/or the level of exposure within a species indicates a change in the pathogen, host, and environment triad. This information is crucial to making disease mitigation and response decisions.

Because WS-Montana has access to many animals either while still alive or shortly after death, it is often requested to opportunistically collect blood and tissue samples for the APHIS-WS National Wildlife Disease Surveillance and Emergency Response Program as an additional part of its field operations and to share that data with MFWP. From FY2013-FY2017, WS-Montana collected an annual average of 506 blood samples from mammalian predators to test for the presence of plague and tularemia, primarily coyote blood samples. Requests for samples have increased substantially, especially because of the new APHIS-WS National Wildlife Disease Surveillance and Emergency Response Program. Blood samples for plague identify plague "hot spots" within Montana, which can assist county health departments provide public notification regarding the risk of plague contact in these areas. In addition, identification of plaque hot-spots has aided the USFWS in their black-footed ferret restoration efforts. WS-Montana does not kill animals for this purpose; all samples are collected as a by-product of normal operations.

Disease surveillance and monitoring as a component of existing IPDM activities increases program efficiency. Further, under this opportunistic sampling method, only those predators captured as part of IPDM activities are sampled for pathogens, thus eliminating the additive wildlife mortality that would be incurred if the IPDM and wildlife disease programs were separate. Additionally, by removing individuals, IPDM activities reduce the number of potential disease hosts, which may contribute to pathogen control.

WS-Montana also collected samples for several other diseases in the last several years at the request of concerned citizens and cooperating agencies because of concern with health risks to people and pets. WS-Montana expects this trend to continue in the future as urban development expands and the risk of disease transmission to humans continues to increase.

1.12 What is the Effectiveness of the National APHIS-WS Program?

1.12.1 What are Considerations for Evaluating Program Effectiveness?

The purpose behind integrated wildlife damage management is to implement methods in the most effective manner while minimizing the potentially harmful effects on people, target and non-target species, and the environment. Defining the effectiveness of any damage management activity or set of activities often occurs in terms of losses or risks potentially reduced. However, estimating levels of damage prevented can be complicated. One of WS-Montana objectives is to ensure that all IPDM actions cumulatively would not cause adverse effects on statewide target predator populations, or on populations of non-target species (Sections 3.5 and 3.7).

Effectiveness is based on many factors, with the focus on meeting the desired IWDM objectives. These factors can include the types of methods used and the skill of the person using them, with careful implementation of legal restrictions and best implementation practices. Environmental conditions such as weather, terrain, vegetation, and presence of humans, pets, and non-target animals can also be important considerations.

To maximize effectiveness, field personnel must be able to consistently apply the Decision Model to assess the damage problem, determine the most advantageous methods or actions, and implement the strategic management actions expeditiously, conscientiously, ethically, and humanely to address the problem and minimize harm to non-target animals, people, property, and the environment. Wildlife management professionals recognize that the most effective approach to resolving any wildlife damage problem is to use an adaptive integrated approach, which may call for the strategic use of several management methods simultaneously or sequentially (Courchamp et al. 2003).

APHIS-WS and professional wildlife managers acknowledge that the damage problem may return after a period of time regardless of the lethal and/or non-lethal strategies are applied. This may be attributed to attractants that continue to exist at the location where damage occurred, predator densities and/or the availability of other individuals to immigrate into the area, and/or if predators cannot be fully restricted from accessing the problem area, such as by fencing, due to conditions and size of the damage site. However, effectiveness is determined by the ability to reduce the risk of damage or threats caused by predators at the time and, if possible, in the future.

The ability of an animal population to sustain a certain level of removal and to eventually return to pre-management levels does not mean management strategies were not effective for addressing the particular event. Periodic lethal and/or non-lethal management actions taken during a critical time of the year in specific places may be necessary to address specific threats. The return of local populations to pre-management levels also demonstrates that the species can tolerate localized removals while having minimal impacts on the species' population (Sections 3.5, 3.7, and 3.8).

Dispersing and relocating problem predators, particularly animals that have learned to take advantage of resources and habitats associated with humans, could move the problem from one area to another. Alternatively, the relocated animal could return to its original trapping site. Relocation of wild animals is also discouraged by WS-Montana policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates due to intraspecific competition with established resident animals of the same species, and difficulties in adapting to new locations or habitats. Relocation of captured problem animals is also opposed by the American Veterinary Medical Association, the National Association of State Public Health Veterinarians, and the Council of State and Territorial Epidemiologists because of the risk of disease transmission among wild mammals.

MFWP does not relocate smaller predators, such as coyotes, that come in conflict with humans because of the healthy size of the populations statewide and the high risk of moving the problem along with the animal. These MFWP policies avoid causing damage problems in the receiving site, reduce the risk that the animal will return to its original home range, and avoid potentially causing the death of the animal due to occupied territories or unfamiliarity with the new location. MFWP may relocate black bears, grizzly bears, and mountain lions in an attempt to resolve human-wildlife conflicts (Dood et al. 2006, Montana Fish Wildlife and Parks 2013;2019b). Release locations are made publicly available within a week of relocation at https://fwp.mt.gov/.

Based on an evaluation of the damage situation using the Decision Model (USDA Wildlife Services 2014b), the most effective methods should be used individually or in combination based on experience, training, and sound wildlife management principles. The effectiveness of methods are evaluated on a case-by-case basis by the field employee as part of the decision-making process using the Decision Model for each IPDM action and, where appropriate, field personnel follow-up with the cooperator.

1.12.2 How Has the U.S. Government Evaluated the Effectiveness of APHIS-WS PDM Activities?

Different values can and do exist among wildlife management agencies, APHIS-WS cooperators, and animal rights and conservation groups regarding wildlife removals, especially lethal removals (Lute and Attari 2016). For meeting various objectives, the government recently conducted two detailed audits of APHIS-WS IPDM programs, including the effectiveness of the programs and compliance with federal and state laws and regulations (United States General Accounting Office 2001, Office of Inspector General 2015). The audits found that the APHIS-WS IPDM programs were both effective and cost-effective.

1.12.2.1 2015 USDA Office of Inspector General Report for Program Effectiveness

In FY2014, the USDA Office of Inspector General (OIG), conducted a formal audit of the APHIS-WS Wildlife Damage Management program (Office of the Inspector General 2015).

The primary objective of the audit was to determine if wildlife damage management activities were justified and effective.

The audit was conducted because the agency had received considerable media attention creating controversy among the general public, animal rights organizations, and conservation groups based on allegations of unsanctioned activities conducted by some of APHIS-WS field personnel. The OIG had received numerous hotline complaints and letters from the general public and animal rights and environmental groups alleging the use of indiscriminate methods capturing non-target species, animals not dying immediately with associated concerns about humaneness (especially being held in traps), and allegations of lack of agency transparency regarding its activities.

For the audit, OIG representatives:

- Observed 40 APHIS-WS field personnel from five states, with audit locations selected based on high numbers of take of selected predators, the most unintentional kills, and/or the most hours on the job with the fewest take;
- Interviewed 15 property owners/managers and 27 state game and wildlife officials;
- Reviewed Cooperative Service Agreements;
- Sampled logbook entries and reconciled them with the MIS data from January 2012 through January 2014; and
- Reviewed NEPA documentation for predator control.

Auditors observed field personnel setting and checking traps, snares, M-44 devices, and conducting other typical field activities, and interviewed the employees regarding their use of the Decision Model to assess predation, including auditor confirmation of predator kills of livestock. The auditors watched specifically for indiscriminate killing of non-target animals and suffering of captured animals not immediately killed by the field employees, and found that the field personnel were "generally following prescribed and allowable practices to either avoid or mitigate these conditions."

In cases where non-target animals were captured or animals not killed immediately, the field employee had followed prescribed agency practices, adhering to applicable laws and regulations. Auditors also observed two aerial shooting operations, one for coyotes and one for feral swine, with good coordination between aerial and ground crews and full adherence to applicable laws and regulations. Auditors observed that all producers visited we(Berger 2006)re using some form of non-lethal predator management, such as fencing, guard animals, and human herders, and noted that producers, not APHIS-WS field personnel, most appropriately are responsible for implementing such methods because most available non-lethal methods focus on management of the conditions rather than management of the offending animal.

The audit found that operations involving field personnel and aerial shooting operations "revealed no systemic problems with the process or manner with which the APHIS-WS conducted its predator control program, complying with all applicable federal and state laws and regulations and APHIS-WS' directives associated with wildlife damage management activities." The auditors also recognized that "Federal law provides WS broad authority in conducting its program. It also allows WS to take any action the Secretary considers necessary with regards to injurious animal species, in conducting the program."

Based on the interviews, the OIG concluded:

> "As one property owner put it, "WS [field specialists] are an absolute necessity for our business. The number of sheep they save is huge and we cannot function

> without them…WS specialists are professional and good at what they do." In support of this same point, a State game official we interviewed explained that WS provides help for wildlife and is run efficiently. A State agricultural official we interviewed characterized the collaboration of State and federal programs to manage control of predators and protect domestic livestock and wildlife as 'seamless.' "

OIG had no findings or recommendations to improve the field operational and aerial shooting program actions and found them both to be justified and effective.

1.12.2.2 2001 Government Accountability Office (GAO) Report to Congressional Committees

The U.S. Government Accountability Office (GAO) is an independent, nonpartisan agency that works for Congress. Often called the "Congressional watchdog," GAO investigates how the federal government spends taxpayer dollars (http://www.gao.gov/about/index.html). At the request of Congress, the GAO conducted a review of the APHIS-WS' IPDM program in 2001 (United States General Accounting Office 2001) to determine:

- The nature and severity of threats posed by wildlife (is there a need for APHIS-WS programs?);
- Actions the program has taken to reduce such threats;
- Studies conducted by APHIS-WS to assess specific costs and benefits of program activities; and
- Opportunities for developing effective non-lethal methods of predator control on farms and ranches.

The GAO met with APHIS-WS personnel at the regional offices, program offices in four states, field research stations in Ohio and Utah, and the National Wildlife Research Center in Colorado. In each state visited, they interviewed program clients, including farmers, ranchers and federal and state wildlife management officials. To obtain information on costs and benefits, they interviewed APHIS-WS economists, APHIS-WS researchers and operations personnel, program clients, and academicians. They also interviewed wildlife advocacy organizations, including the Humane Society of the United States and Defenders of Wildlife, and conducted and an extensive literature survey.

The report summary states:

> "Wildlife Services scientists are focusing most of their research on developing improved non-lethal control techniques. In FY2000, about $9 million, or about 75% of the program's total research funding (federal and nonfederal) was directed towards such efforts. However, developing effective, practical, and economical non-lethal control methods has been a challenge, largely for two reasons. First, some methods that appeared to be promising early on proved to be less effective when tested further. Second, animals often adapt to non-lethal measures, such as scare devices (e.g., bursts of sound or light)."

The GAO review found that most non-lethal control methods – such as fencing, guard animals, and animal husbandry practices – are most appropriately implemented by the livestock producers themselves, with technical assistance from APHIS-WS, and most cooperators are already using some non-lethal methods before they request assistance from APHIS-WS.

1.12.3 Conclusion

Two recent detailed and extensive government audits of the APHIS-WS IPDM program, one requested by Congress and one conducted by the USDA Office of Inspector General, found that the need exists for IPDM on public and private lands using both lethal and non-lethal methods as implemented by APHIS-WS when requested for protecting:

- Human health and safety, including threats from predators and zoonoses,
- Livestock, agricultural crops, and other assets and property, and
- Resources under the jurisdiction of federal and state wildlife agencies.

The audits found that:

- Such programs are cost-effective and justified;
- The programs are conducted in compliance with federal and state laws and agency policies and directives; and
- The programs are both desired and effective in meeting the needs.

1.12.4 What is the Efficacy of Predator Control for Protection of Livestock from coyotes, bears, wolves, and mountain lions?

1.12.4.1 Background

Studies of effectiveness at reducing livestock depredation often inappropriately mix broad-scale studies at state-wide levels with local, ranch-scale studies (for example, (Harper et al. 2008, Poudyal et al. 2016), and studies involving seasonal livestock grazing (where livestock may be within an animal's home range for part of the year) and year-round livestock grazing (Blejwas et al. 2002).

WS-Montana IPDM works at reducing livestock losses at the producer/cooperator level. Any livestock protection strategy must involve a partnership between the producers and WS-Montana IPDM personnel to tailor methods to effectively address specific damage situations. A large proportion of WS-Montana IPDM work involves requests for assistance in addressing coyote depredation on livestock (Sections 1.11.2 and 3.5). Routinely, removing individual predators such as raccoons, badgers, and foxes takes care of the problem, especially if the cooperator also partners with WS-Montana to address the conditions causing the problems. Coyote depredation, however, may be a recurring problem, especially in areas where lambing and calving overlaps with coyote territories and movements. The high degree of selectivity of lethal and capture methods used by WS-Montana for all IPDM activities involving predators included in this EA is discussed in Section 1.12., along with method humaneness information in Section 3.9. Therefore, this discussion will focus primarily on the effectiveness of WS-Montana IPDM lethal and non-lethal methods for addressing livestock depredation.

Effective coyote damage management depends on the nature of the problem, presence or absence of historical patterns, relative size of the area, season of year, timing of depredations or anticipated depredations, and efficacy, selectivity, and efficiency of methods used (Knowlton et al. 1999). Linnell et al. (1999) address the potential effectiveness of focusing predator control efforts on problem individuals (individuals that kill more livestock than others) rather than populations as a whole.

Considering the effectiveness of methods or combinations of methods should optimize the degree of intensive management relative to the biological importance of individual predators in the population, since each method typically works for a limited period of time as new animals replace those removed, and management methods should be used during the season or period having the greatest potential for conflicts between predators and humans. The primary factors that should be considered when developing an IPDM strategy include efficiency, economics and success at resolving depredation. The success of a management technique often must be measured by the tolerance of humans to predators, their presence, and resulting damage (Shivik 2006)(Section 1.4.3).

1.12.4.2 Coyote Population and Social Dynamics Related to Livestock Predation and Management

Since the Knowlton and Stoddart (1983) study was published, researchers and IPDM practitioners agree that, at a minimum, the territorial alpha pair is the basic unit of coyote populations. Recent studies indicate that livestock located within or near coyote territories, especially during the temporal overlap of livestock calving/lambing and coyote pupping seasons, may experience a higher level of predation. Studies have found that coyote livestock depredation is almost exclusively caused by the alpha breeding pair (Sacks 1996, Knowlton et al. 1999, Blejwas et al. 2002, Jaeger 2004). Within a pack, only the alpha pair breed and need only recruit 10% of their young to maintain a population (Knowlton et al. 1999). Consequently, population size and territories tend to remain relatively stable over time.

Coyote depredation rates also appear to be influenced by livestock husbandry and management practices, breed and age of livestock, environmental factors, coyote biology and pack behavior, and the type and intensity of depredation management programs (Knowlton et al. 1999). Studies have shown that removal of what appear to be the "problem individuals" (corrective removal) even without knowing their status within the pack, and preventive removal prior to the livestock lambing/calving season, may also be effective at the ranch/farm level, for example, Wagner and Conover (1999).

Effectiveness of IPDM Methods for Coyote Depredations

Authors have discussed the effectiveness and selectivity of various methods commonly used by producers and/or IPDM field personnel (Table 1.13). For capture and removal methods, effectiveness and selectivity also depends highly on the skill, experience, and expertise of the user.

Table 1.13. Effectiveness of Coyote Depredation Reduction Methods (adapted from (Mitchell et al. 2004), (Jaeger 2004), (Shivik 2006), (Shivik et al. 2014).

Non-lethal Methods		
Method	**Advantages**	**Disadvantages**
Fencing	May be nearly 100% effective if constructed correctly (high, and cannot dig under)	Only effective in small areas where livestock can be enclosed and watched; high construction and maintenance costs
Birthing sheds, lighting corrals at night	May be effective with sufficient human presence	Only effective in small areas where livestock can be enclosed and watched; high construction and maintenance costs
Herders	May be effective with unpredictable and constant human presence	Human-intensive; only effective if stock are not widely dispersed in areas with sufficient cover for predators
Guard animals (dogs, llamas, donkeys)	May be effective with unpredictable and constant human presence, and if well trained	Only effective if stock are not widely dispersed in areas with sufficient cover for predators; may be killed by predators; may attack pets if in recreation area; some may begin to kill livestock
Physical harassment (paintball with capsicum powder, rubber bullets, beanbag rounds, harassing dogs)	May be effective with unpredictable and constant human presence; addresses individual animals causing conflict at the time of conflict or potential conflict	Some ammunition may be limited to use by law enforcement; some ammunition, such as rubber bullets, may harm animals; harassment may have to be repeated if animals become habituated
Aversion (lithium chloride)	May be effective for short term, if the animal can tie it directly to the presence of livestock	Not effective if in baits, because animal does not associate the aversion with the livestock attacked; must be maintained; animals may habituate
Shock collars attached through snares	Still in testing stage	Expensive; must be attached to depredating animal through a snare or capture, and activated when the animal is near livestock
Electronic guard strobe light/alarm sound	Needs collared animals to activate the mechanism so that the harassment is directly associated with the activities, rather than random activation	Animals may habituate rapidly to random activation, especially if the animal does not associate the alarm with their presence; not currently commercially available
Sterilization	May be effective if sterilized alpha breeding pair maintain territory without pups in areas where livestock is seasonal	May be difficult to identify alpha breeding pair unless at the den; may be expensive and labor intensive if alpha pair not identified
Lethal Methods (more effective when selective for target species and offending individuals; may be important tool for a successful reintroduction of a large predator		

because of the option for removing them when they cause conflict; improves trust of cooperators in effectiveness)		
Capture and lethal devices (traps, snares, M-44s)	Highly selective for species when used with appropriate baits, sets, and equipment	May not be as selective for targeting individual coyotes; younger, beta, transient coyotes substantially more vulnerable than alpha coyotes in territory
Aerial shooting	Highly selective for species, indication of pre-season effectiveness under some circumstances	May not be as selective for targeting individual coyotes; younger, beta, transient coyotes substantially more vulnerable than alpha coyotes in territory; unable to know if alpha coyote unless associated with a den
Sodium nitrate canisters (denning)	Highly selective for targeted alpha breeding pair to reduce depredation; reduces need to kill other adult coyotes that may not be offenders	May have problems with negative public perception
Coyote calling/ground shooting	Highly selective for species, possibly for individuals; calling may be used to lead field personnel to the den	May not target individual offending animals unless occurring at or near the time of depredation or animals are associated with a den; may also involve beta animals, especially helper animals at the den

1.12.4.3 Effectiveness of IPDM Methods for Wolf Livestock Depredations

Bradley et al. (2015a) evaluated the effectiveness of three wolf management treatments in reducing livestock depredation in Montana, Idaho, and Wyoming. The study analyzed 967 depredations by 156 wolf packs on primarily sheep and cattle operations. The authors found that in the absence of lethal removal, the median time to the next depredation event was 19 days, lethal removal of some of the pack members resulted in a median recurrence time of 64 days, and removal of the entire pack resulted in a median recurrence time of 730 days after a new pack occupied the territory. The authors suggest that pack size is the best predictor of recurring depredation events, with the probability of such an occurrence increased by 7% for each animal left in the pack. In addition, the authors indicated that the effectiveness of wolf management in reducing depredation must be evaluated at the wolf pack or territory level (also suggested by (Musiani et al. 2005)), while recovery of wolf populations must be evaluated at a broader regional or statewide scale. With no or partial removal, 53% and 31% of the packs, respectively, were counted as breeding pairs the following year, increasing the risk of depredation. The authors could not evaluate the effectiveness of non-lethal preventative methods, such as husbandry, fencing, and harassment, because of the wide diversity of methods used, inconsistency in their application, and sparse record keeping. As with other studies, the authors caution against extrapolating their findings to other areas and time periods.

DeCesare et al. (2018) analyzed the spatial and temporal patterns of wolf-livestock conflicts between 2005 and 2015 in Montana and evaluated the effectiveness of hunting and targeted management removals in decreasing wolf-livestock conflicts. The strongest predictor of wolf-livestock depredations was the occurrence of depredations in the previous year in addition to wolf density and livestock density. Targeted removal of wolves decreased the probability of having depredations the following years; whereas, hunter harvest did not reduce the probability of depredations in areas with reoccurring conflicts. Management implications from this study include "an equal split between preventative efforts to reduce the propensity for conflicts in places where they are less common and reactive efforts to reduce the severity of number of conflicts in places where they are more common." Results from this study support the use of targeted lethal removals to reduce recurrent depredations.

Stone et al. (2017) studied adaptive use of non-lethal strategies for minimizing wolf depredation on sheep managed on open range grazing operations in Idaho including increased human presence, increased numbers of livestock guarding dogs, spotlights, harassment devices activated by radio collars on wolves; fladry and turbo-fladry; starter pistols and air horns, klaxon, flashing lights and increasing prevention activities when radio-collared wolves approached. Method selections were made in collaboration with shepherds and managers based on terrain, proximity to wolf den or rendezvous sites, and avoiding overexposure to harassment methods that might result in habituation. Additional methods employed include camping near sheep bedding-grounds, devising alternative grazing rotations to avoid encounters, and alternating harassment methods to minimize habituation.

Stone et al. (2017) compared depredations in the area where non-lethal strategies were deployed to an area where lethal removal was the tool utilized to protect sheep. During the 7 years of this study sheep depredations caused by wolves were 3.5 times higher in the area protected by lethal removal of wolves. This was not a rigorous study design with randomized treatment and control sites that contrasted management strategies, thus the authors recommend that the results should be interpreted cautiously. There could be inherent differences in predation rates from the area in which their case study occurred that are not accounted for in their study design. Furthermore, as pointed out in the paper, they did not consider regulated hunting and trapping and administrative removal of entire wolf packs that was ongoing in the area, which could have impacted their results in unknown ways.

The authors recommend a combined approach incorporating consistent human presence at night, wolf monitoring with radio collars to determine and predict pack movements, and appropriate deterrents carefully applied. Estimated costs from the projects ranged from $22,000 to $48,000 annually, with technician labor and field transportation representing more than 85% of the total annual costs. An unquantified but significant amount of labor was provided as volunteer help, which was not included in the calculated costs. The applicability of this study to other systems is unknown, for example, with cattle in open range grazing situations. The conclusion that increased human presence and the use of non-lethal tools in an adaptive fashion could apply as recommendations for livestock producers is something that WS-Montana has taken into consideration. WS-Montana has hired two non-lethal only conflict prevention specialists to begin implementing adaptive approaches to reduce conflicts between livestock and large carnivores.

1.12.4.4 Efficacy of IPDM for bear livestock depredations

An integrated response to black bear and grizzly bear damage often begins with securing attractants and deterring bears from anthropogenic food sources. In Montana conflict prevention for bears consists of electric fencing, bear proof garbage and grain bins, and range rider and carcass removal programs. Efforts to examine the effectiveness of the conflict prevention methods indicate that these tools can deter bears from anthropogenic food sources (Sillings et al. 1989, Madel 1996, Huygens and Hayashi 1999, Witmer and Whittaker 2001, Zaranek 2016, Johnson et al. 2018).

Preventing food conditioning of bears is a critical step in bear damage management because it provides an opportunity to maintain selection for native food sources. Once habituation occurs management options are limited to relocation or removal. Relocation is discussed at length in Section 1.11.4.9. Selective removal of depredating individuals is recognized by wildlife biologists as being a viable and effective means of reducing black bear and grizzly bear damage (Poelker and Hartwell 1973, U.S. Forest Service 1986, Raithel 2017). Selective removal is seen as an effective response for two reasons. First, it ends the learned, damage-causing behavior without risk of moving the behavior to another area (Section 1.11.4.9) or passing the behavior down to future generations (Mazur and Seher 2008). Second, ending continuous damage caused by a single individual increases social tolerance for bears that are not causing damage.

Raithel (2017) indicates that reports of nuisance behaviors declined as a result of hunter harvest and lethal management applied in the previous year. Interestingly, this study showed that bears identified as nuisance bears were more likely to be harvested in subsequent years; this trend was not observed in other studies of hunter harvest (Treves et al. 2010, Obbard et al. 2014). It is possible the ability of hunter harvest to reduce nuisance behaviors varies depending on the degree to which anthropogenic food sources permeate the landscape and annual variation in natural food availability. In areas where suburban development dominates the landscape, hunter harvest may be an effective management tool to decrease nuisance behaviors. In areas dominated by large intact open spaces (e.g. National forests or working lands), lethal removal may be a more effective management strategy to reduce nuisance behaviors.

1.12.4.5 Conclusions

Most authors recognize that more research is needed regarding coyote ecology and biology related to social dynamics and use of livestock and natural prey, and costs, benefits, and disadvantages (Knowlton et al. 1999, Blejwas et al. 2002, Mitchell et al. 2004).

Because of inherent population dynamics of predators such as coyotes, bears, wolves, and mountain lions, including immigration/emigration, recruitment, territoriality, social dynamics, and inherent behavioral and learning adaptability, as well as differences in livestock management methods and changing circumstances, IPDM for livestock protection will by definition be short-term and necessarily repeated as needed (Knowlton et al. 1999, Mosnier et al. 2008). Targeting the individual(s) causing the conflicts is a demonstrated way to address specific conflict situations. APHIS-WS NWRC is constantly working to develop and test new lethal and non-lethal methods for predators. APHIS-WS and WS-Montana field personnel are highly experienced and trained in use and deployment of methods to increase effectiveness and selectivity (Sections 3.7 and 3.9).

WS-Montana is consistently requested to assist with depredation and damage involving many different large predators, including coyotes, wolves, bears, and mountain lions. The targeted IPDM methods and applications, both lethal and non-lethal, have been shown to effectively assist cooperators with losses and damage, improving the economic viability of individual operations.

1.12.5 Are Field Studies of Effectiveness of Lethal PDM for Livestock Protection Sufficient for Informed Decision-Making?

An analysis of effectiveness of each of the WS-Montana alternatives considered in detail is found in Chapter 3, including the effectiveness of PDM based on the literature, and how it relates to predator population sustainability (Section 3.2), mesopredator release (Section 3.8) and ecosystem function (Section 3.8).

A recent paper (Treves et al. 2016) criticizes research methods used for evaluating the effectiveness of lethal PDM for protection of livestock and recommends suspension of such PDM methods that do not currently have rigorous evidence for functional effectiveness until studies are conducted using what the authors call a "gold standard" study protocol. The "gold standard" protocol recommended by the authors is called the Before/After-Control/Impact (BACI) protocol, which uses a sampling framework to attempt to assess status and trends of physical and biological responses to major human-caused perturbations in the environment. It involves sampling in the area proposed for perturbation before the perturbation occurs and after the perturbation occurs, and comparing the results to each other and to those measured in a control area. This protocol is often used in controlled biomedical research and point-source pollution or localized restoration studies, where the human-caused perturbation is relatively localized and non-mobile.

In order to meet the "gold standard" requested by Treves et al. (2016), BACI is best applied using multiple control sites that are sufficiently similar to the perturbed site (Underwood 1992) in order to overcome inherent natural variability in ecological systems, a very difficult standard. Unreplicated sampling involved in the BACI model inherently does not provide the strong inferences that Treves et al. (2016) requests for their "gold standard" (Underwood 1992).

In the case of predation management on livestock, finding multiple field study sites that not only prohibit predator management while also allowing livestock grazing is difficult. As experienced in Marin County, California, in the absence of professional predator removal, livestock producers often hire a commercial company or remove animals themselves, often using methods that are not selective for the offending animal (Shwiff et al. 2005, Larson 2006).

Depredation on livestock involves highly mobile animals capable of learning and behavior adaption, with seasonal and social biological variations, tested against highly variable livestock management practices and inherently highly variable conditions such as weather, unrelated human activities (such as hunting or recreation), and natural fluctuations in habitat and prey quality and abundance.

APHIS-WS understands and appreciates interest in ensuring PDM methods are as robust and effective as possible. The APHIS-WS NWRC collaborates with experts from around the world to conduct these studies and findings are published in peer-reviewed literature. APHIS-WS supports the use of and uses rigorous, scientifically sound study protocols. APHIS-WS also realizes that field studies involve many variables that cannot be controlled and assumptions that must be acknowledged when trying to analyze complex ecological questions. Wildlife research is inherently challenging because scientists are not working in a "closed" system, such as a laboratory. Researchers must apply study protocols that are capable of differentiating between natural inherent fluctuations and statistically meaningful differences.

Two alternative field designs that are commonly used in wildlife research include a switch-back model and paired-block approach. In the case of a study of the effectiveness of predator management methods on addressing livestock depredation, a switch-back study design involves at least two study areas, one (or more) with predator removal and one (or more) without predator removal. After at least two years of data collection, the sites are switched so that the one with predator removal becomes the one without predator removal, and vice versa, with an additional two years of data collection. The paired-block design involves finding multiple sites that are similar that can be paired and compared. For each pair, predators are removed from one site and not from the other. Using study designs with radio collars on highly-mobile terrestrial predators with interacting social systems also provide a robust method for determining the actual movements, locations, periodicity and seasonality, activity type, social interactions, habitat use, scavenging behavior, and other important factors associated with individual animals, allowing statistical analysis for some study questions and providing the capability for clearer conclusions.

Underwood (1992) states: "BACI design, however well intentioned, is not sufficient to demonstrate the existence of an impact that might unambiguously be associated with some human activity thought to cause it…[because] there is no logical or rational reason why any apparently detected impact should be attributed to the human disturbance of the apparently impacted location…Thus, such unreplicated sampling can always result in differences of opinion about what the results mean, leaving, as usual, the entire assessment to those random processes known as the legal system."

Therefore, APHIS-WS has determined that it is fully appropriate to continue using existing tools and methodologies, and to continue developing and testing new tools and methods to meet the need for PDM per its statutory mission.

1.13 What Role Does Cost-Effectiveness Play in IWDM and NEPA?

A common concern expressed by commenters about government-supported predator damage management is whether the value of livestock losses are less than the cost of using at least some public funds to provide predator damage management services.

However, this concern indicates a misconception of the purpose of predator damage management, which is not to wait until the value of losses is high, but to prevent, minimize, or stop losses and damage where it is being experienced, the property owner's level of tolerance has been reached, and assistance is requested. Predator damage management would reach its maximum success if it prevented all losses or damage, which would mean the value of losses or damage due to predators would be zero. However, it is not reasonable to expect zero loss or damage (see Section 1.11.2). Also, wildlife damage management involves not only the direct costs (costs of actual lethal and non-lethal management) but also the considerations of effectiveness, minimization of risk to people, property, and the environment, and social considerations (Shwiff and Bodenchuk 2004).

Evaluating the economic value of losses that would be avoided or minimized with implementation of a predator damage management program is inherently difficult and very complex (Shwiff and Bodenchuk 2004). Relevant scientific literature suggests that, in the absence of predation management, predation rates on livestock would likely increase (Nass 1977, Howard Jr. and Shaw 1978, Nass 1980, O'Gara et al. 1983, Bodenchuk et al. 2002). See Section 1.11.2.

Methodologies that attempt to evaluate the economic values of livestock losses and reducing those losses can depend on many variables, such as local market values for livestock, age, class and type of livestock preyed upon; management practices used; geographic and demographic differences; and applicable laws and regulations. However, attempting to evaluate the economic value of the predator itself is even more difficult, because wildlife populations have no inherent measurable monetary value, and any such value must therefore be evaluated indirectly, such as through willingness to pay for consumptive or non-consumptive recreation, for example (Section 1.13.6). Section 1.13.4 discusses other factors, complexities, and methods involved in evaluating the economic values of predator damage management.

1.13.1 Does APHIS-WS Authorizing Legislation Require an Economic Analysis?

The statute of 1931, as amended does not incorporate consideration of economic valuations and cost-effectiveness for the IWDM program as part of decision-making (Section 1.5.1). In addition to authorizing the IWDM services, it provides for entering into agreements for collecting funds from cooperators for the services the agency provides.

1.13.2 Do NEPA and the CEQ Require an Economic Analysis for Informed Decision-making?

Section 102(2)(B) of NEPA requires agencies to:

> "[I]dentify and develop methods and procedures...which will ensure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations…"

NEPA ensures that federal agencies appropriately integrate values and effects that cannot be quantified from an effects or cost-effectiveness standpoint into decision-making. Such unquantifiable values can include, for example, the value of viewing wildlife, human health and safety, aesthetics, and recreation.

WS-Montana has determined that there are important qualitative values that are relevant and important to its decision-making that are considered in this EA, but that those considerations will not be monetized. Estimates of non-monetary cost and benefit values for public projects that are not priced in private markets can be difficult to obtain, and methodologies can only produce implied monetary values that are subjective and require value judgments. Selecting an appropriate discount rate to measure the present monetary value of costs and benefits that will occur in the future is also difficult and subjective, with the level of the discount rate creating dramatically different project benefits.

Cost-effectiveness is an important factor in IPDM decisions but not the primary goal of APHIS-WS. Whenever a request for assistance is received, WS-Montana field personnel consider additional constraints, such as environmental protection, land management goals, presence of people and pets, and social factors using the Decision Model. These constraints may increase the cost of implementing IPDM actions while not necessarily increasing its effectiveness, yet they are a vital part of the APHIS-WS program (Connolly 1981, Shwiff and Bodenchuk 2004). Connolly (1981) examined the issue of cost-effectiveness of federal predator damage management and concluded that public policy decisions have been made to steer the program away from being as cost-effective as possible, including the restriction of management methods believed to be highly effective but less environmentally or socially preferable, such as toxic baits, including traps and the livestock protection collar (LPC), which is highly specific to the offending animal (Shelton 2004). Also, state and local jurisdictions are limiting the methods available for IPDM. Thus, the increased costs of implementing the remaining more environmentally and socially acceptable methods to achieve other public benefits besides resource and asset protection could be viewed as mitigation for the loss of effectiveness in reducing damage.

Services that ecosystems provide to resources of value to humans can be considered in qualitative and/or economic terms. The Memorandum entitled "Incorporating Ecosystem Services into Federal Decision Making" https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2016/m-16-01.pdf issued by the CEQ, the Office of Management and Budget (OMB) and the Office of Science and Technology Policy (OSTP) on October 7, 2015 does not require an economic test for the ecological services to be considered valuable. Therefore, neither NEPA nor CEQ guidance requires economic analyses for informed decision-making unless relevant to the understanding differences among alternatives.

The qualitative considerations at issue in this EA are evaluated in Chapter 3 and the agency's decision based on all considerations, including non-quantifiable values, will be explained in the decision document.

1.13.2.1 Are the Recommendations of Loomis (2012) for Economic Analysis Applicable to APHIS-WS Activities?

Loomis (2012) argues, and Bergstrom et al. (2014) agrees, that APHIS-WS should apply the same economic approach required by Congress for large capital improvement projects using natural resources (such as water). The agencies the author uses as examples are those that either fund or construct major civil works actions (capital improvement projects) with long life spans, such as the U.S. Army Corps of Engineers (USACE), the Federal Highway Administration (FHWA), the Bureau of Reclamation (BOR), Tennessee Valley Authority (TVA), and the Federal Emergency Management Agency (FEMA). Loomis (2012) especially uses the National Economic Development (NED) requirements for large water projects funded and/or constructed by BOR and USACE as the example for APHIS-WS use. However, Congress has specifically required that the BOR and USACE consider the NED for decision-making for their large civil works water projects (such as large dams, river management, etc.) that "necessarily confronts choices among possible alternative courses of actions that involve tradeoffs in economic and other opportunities" (U.S. Army Corps of Engineers 2009).

It is clear that these examples of agency uses of economic analyses, most of which are Congressional statutory requirements for large civil works projects or other large federally-funded projects, are not directly relevant to a "fee for service" agency such as APHIS-WS in which Congress has not required any economic test for its IWDM services, and which is supported by both Congressional appropriations and cooperator contributions and funds.

1.13.3 How Have Recent Studies Considered Economic Evaluation of WDM Activities?

Recognizing that many factors affect the viability and profitability of livestock operations, such as weather, the cost of wages and supplemental feed, livestock meat and wool market prices (Berger 2006), as well as the increase in synthetic fibers, predation on livestock is clearly one. USDA Veterinary Services (2017) reported that predator losses represented a large percentage of losses when compared with six non-predator related losses of cattle and calves nationwide. For example, predator losses accounted for only 3.5% and 11.1% of cattle and calf losses, respectively (USDA Veterinary Services 2017). Livestock losses due to predation are also not experienced uniformly on all properties across the industry; a few producers often absorb the majority of losses, especially those on public rangelands and private properties adjacent to such protected habitats (Shelton 2004).

A study in Wyoming of ranch-level economic impacts in a range cattle grazing system conducted by economics professors at the University of Wyoming (Rashford et al. 2010), indicates that predation on calves can have a substantial impact on ranch profitability and long-term viability through loss of calves available for sale, increased variable costs (such as hay and feeds, veterinary costs, fuel, equipment repair, trucking, and labor) per calf, and, anecdotally perhaps, weaning rates from predator harassment. The study found that increased calf loss "takes a larger toll on profits because it erodes the ranch's core profit center, calf sales…The results suggest that predation can have significant impacts on both short-term profitability and long-term viability depending on the mechanism [by which predation can affect profits]." The study identifies social and ecosystem benefits to keeping ranches in the western U.S. viable and profitable through the open spaces and wildlife habitat they provide. The study concludes that "predator control activities would only need to reduce death loss due to predators or reduce predator impacts on weaning rates by approximately 1% to be to be economically efficient…The relationship between predation, ranch viability, and the ecosystem services provided may justify public spending on predator control." Conversely, at a larger scale, Berger (2006) suggested that 77% of changes in sheep numbers correlated positively with lamb prices, hay prices and wage rates, and suggested that cash or other subsidies might be more effective (see Section 1.13.6.2 for a discussion on compensation for depredation). However, APHIS-WS is requested to address losses due to predators at the producer level and does not address losses at a broader economic scale. Further research regarding ranch profitability at the producer level is needed, and differs based on ranch-level conditions, operations, and livestock type.

The audit conducted by the (United States General Accounting Office 2001) concluded, based on studies focused on specific APHIS-WS IPDM activities in different areas of the country, they evaluated, that livestock IPDM activities are economical, with benefit to cost ratios ranging from 3:1 (comparing the market value of all livestock saved in 1998 with the cost of all livestock protection programs in place) to 27:1 (comparing total savings with federal program expenditures, including a measure that shows the potential ripple effects on rural economies). IPDM to protect wildlife shows a benefit to cost ratio of 2:1 to 27:1. Activities performed to protect human health and safety are impossible to quantify, but the value of a human life is incalculable. The United States General Accounting Office (2001), however, recognized that estimates of the economic benefits (savings) associated with program activities are based largely on predictions of the damage that would have occurred had the program's control methods been absent, with inherent uncertainties, substantial variations in circumstances, and inability to distinguish between the results of IPDM activities and other factors such as weather, disease, and natural fluctuations in predator and prey populations.

Most economic analyses of the relationship of livestock profitability and predator control are conducted at the scope of contribution to local and regional economies. This approach dilutes the recognition that some ranch operations are impacted financially by predation at a higher rate than others, depending on factors such as livestock being grazed adjacent to quality predator habitat (such as ranches near federal lands resulting in "predator drift;" (Shelton 2004), grazing overlapping with predator territories, and grazing in areas with high concentrations of unprotected livestock, especially during lambing and calving. APHIS-WS operates on individual ranches based solely on need expressed by livestock operators on public and private lands. APHIS-WS does not operate on every ranch operation, only those experiencing predation problems, and then only those requesting assistance from APHIS-WS. APHIS-WS operates predator damage management with paying cooperators at the individual ranch operation level, not the regional level, which is not reflected in typical economic analyses published in the literature (Rashford et al. 2010), (Loomis 2012), for example). This approach also does not consider support for other needs for which APHIS-WS is routinely requested, such as threats to human/pet health and safety, operations at airports, risk of wildlife disease spread, and protection of property.

A team of economic specialists from the NWRC conducted an economic assessment of select benefits and costs of APHIS-WS in California. The assessment focused primarily on damage in agricultural areas because urban wildlife damage figures were not readily available. During the study year, cooperating California counties paid on average 57% of the cost of their WS-California specialists. Results of the study indicate that for every $1.00 California counties invest in APHIS-WS, they save between $6.50 and $10.00 in wildlife damage and replacement program costs (Shwiff et al. 2005, Shwiff et al. 2006). Considering the total cost of APHIS-WS field personnel, the benefits were found to be between $3.71 and $5.70 for every $1.00 of county investment.

Shwiff and Merell (2004) reported 5.4% increases in numbers of calves brought to market when coyotes were removed by aerial shooting. Wagner and Conover (1999) found that the percentage of lambs lost to coyote predation was reduced from 2.8% to less than 1% on grazing allotments in which coyotes were removed 3-6 months before summer sheep grazing.

Variables that would change the cost to benefit ratio of a damage management program include: local market values for livestock, age, class and type of livestock preyed upon, management practices, geographic and demographic differences, local laws and regulations and APHIS-WS polices, the skill and experience of the individual APHIS-WS employee responding to the damage request, and others.

1.13.4 What are the Various Factors and Methods for Evaluating Cost-Effectiveness?

Bodenchuk et al. (2002), Shwiff and Bodenchuk (2004), and Shwiff et al. (2005) describe the primary types of considerations for conducting economic analyses of IPDM:

- **Direct Benefits:** These are typically calculated as the number of individual animals saved from predation, representing a cost savings, in that with predation management a certain number of losses or amounts of costs can be avoided. The dollar value of the species or animals saved represents the direct benefits of the program and the losses avoided by producers. However, determining the market value for livestock and wildlife species saved is difficult, with livestock usually valued using market price, which is typically conservative, and wildlife species using civil values. Number of animals lost in the absence of IPDM activities is difficult to determine. Also reported losses are most likely substantially fewer than actual losses, as many losses are not reported to authorities, not all losses are found in the field, and many carcasses found are too consumed or decayed to make a clear determination of cause of death and species responsible.
- **Spillover Benefits (secondary, indirect, or incidental benefits):** These benefits are an unintentional side effect of the primary purpose of the IPDM program, and may be evaluated using multiplier values from the direct benefits. Spillover benefits can include benefits to wildlife populations in the same geographic area. Indirect benefits can include benefits to local and regional economies.
- **Intangible Benefits:** Such benefits include increased cooperation from landowners as a result of the implementation of IPDM, such as facilitating landowner participation in other conservation efforts or potentially minimizing amateur efforts to control predators, which may not be as selective or humane as those conducted by trained professionals.
- **Direct Economic Effects/Costs:** These costs reflect the value of losses to the livestock operator and the associated reductions in purchases for directly

supporting those livestock as well as the costs of lethal and non-lethal IPDM activities for protection of livestock and/or localized wildlife species, such as valued big game species, recently introduced native species, or ESA-listed species.

- **Indirect Economic Effects:** These effects are generated as livestock loss alters producer purchases of supplies from other industries in the region and outside the region, resulting in additional jobs, increased income for the region, and greater tax revenues.

All of these factors are complicated, interrelated, and difficult to delineate and quantify. As different economic studies use different factors, values, and multipliers, they are very troublesome to make comparisons.

The following summarizes the types of economic analyses typically applied to predator damage management, especially associated with livestock contributions to regional economies as discussed in Schuhmann and Schwabe (2000), Shwiff et al. (2005), Rashford and Grant (2010), Loomis (2012), Shwiff et al. (2012):

- **Cost: Benefit Analysis:** Considers measures of costs that include financial costs (out of pocket expenditures such as for fencing and guard dogs) and opportunity costs (benefits that would not be available to society based on predator control actions taken today) and measures of benefits as evaluated by a consumer's (increase in enjoyment/satisfaction) or producer's (increases in profit) willingness-to-pay (WTP) for one more unit of the identified "good", considered either on a personal level or societal level. On a personal level, the "good" is considered to have economic value if the individual person (recognizing that individuals have differing value systems) receives enjoyment/ satisfaction from the "good" and if the "good" is to some degree scarce. Opportunity costs must also be considered – costs/resources spent on a good that cannot then be used for another purpose. On a societal level, many public natural resources, such as wildlife, may not have a direct market value, but provide satisfaction and enjoyment to some (but not all) segments of society. This is a difficult and subjective analysis (despite its attempt at quantification), as the direct and indirect factors and discount rates included in such an analysis must be carefully considered and evaluated accurately for the contribution they play or this type of analysis can substantially misrepresent the actual situation and/or be readily disputed. See Section 1.14.2.1 for an explanation of how this approach is used for large capital improvement projects considered on a project-level basis but applied on a regional and national basis as the foundation for determining if and what level the federal government will provide Congressional appropriations. Congress requires this approach for several agencies for such capital improvement projects for setting federal policy in the large-scale public interest.

- **Willingness to Pay:** Studies have identified the WTP for non-market goods such as wildlife recreation (mostly hunting, fishing, and wildlife viewing) for individual species, and, to a substantially lesser degree, ecosystem services, such as clean drinking water, pollination and pest control for agriculture, and renewal of soil fertility. WTP can also be used to monetize existence or passive values, such as the value of knowing that a species exists somewhere in the wild, even if the individual never spends any money to actually experience it in the wild.

- Methods used to determine or using WTP have included:
  - **Recreational Benefits:** Considering the costs of travel to experience enjoyment of non-market recreational experiences (Travel-Cost Method; TCM), using a demand curve above actual travel costs obtained through surveys with recreationists, reflecting actual behavior. Shwiff et al. (2012) summarize the primary criticisms of TCM: assumptions that visitors' values equal or exceed their travel costs, because travel costs are not an accurate proxy for of the actual value of the good; values must also be assigned to the time individuals spend traveling to the site, including opportunity costs (time spent traveling cannot be spent doing some other activity) since each person values their time differently; human access to conservation sites may be limited (including access to private land) and individuals may not be aware or have a preference toward the species associated with a chosen recreation site; and if individuals are not willing or able to travel to the site to expend funds, then this method confers no value.
  - **Existence/ Altruistic/Bequest Benefits** (depending on whether the benefit is enjoyed by the individual now or by other individuals now, or by other individuals in the future): Constructing a hypothetical or simulated market and surveying individuals if they would pay an increase in their trip costs or an increase in their taxes/utility bills/ overall prices for increasing environmental quality, including wildlife populations, recognizing that they higher the dollar amount respondents are asked to pay, the lower the probability that they would actually pay (Contingent Valuation Method; CVM). This includes situations in which individuals are willing to provide donations to environmental groups to protect resources that they care about but may never experience themselves. Shwiff et al. (2012) summarize the primary criticisms of CVM: the hypothetical nature of the questionnaires, the inability to validate responses, the high costs of conducting this type of survey, and the difficulty of identifying the target audience. Also, public goods such as wildlife do not lend themselves to this type of valuation and this valuation tends to understate the true non-market value.
  - **Benefit Transfer to Other Locations:** Extrapolation of WTP results from one area to another, recognizing that the extrapolation may or may not be reasonable or applicable in another area depending on circumstances. Shwiff et al. (2012) summarize the primary criticisms of the benefit transfer method: the reliability of this methods may be inconsistent as this method depends on estimates created using the CVM or TCM methods; wildlife values in one area may be unique and simply transferring the value associated with a species in one location to the same species in another location does not capture local qualities; preferences and

willingness to pay for those preferences may not account for all the values and benefits of wildlife conservation projects, including ecosystem services.

- **Regional Economic Analysis:** Shwiff et al. (2012) describe this method as including estimation of secondary benefits and costs associated with the conservation of wildlife species in units of measure that are important to the general public (revenue, costs, and jobs). Increasing wildlife populations (the primary benefit) may have secondary benefits such as increase consumptive and non-consumptive tourism, which can be estimated using multipliers to account for changes spread through economic sectors. Loomis and Richardson (2001) used WTP estimates obtained from CVM and TCM studies for estimating the value of the wilderness system in the United States. This requires the use of computer models, which can translate conservation efforts into regional impacts on revenue and jobs. However, secondary benefits or costs cannot be incorporated into a cost-benefit analysis because losses in one region may become gains in another region, potentially leading to offsetting effects.

As Schuhmann and Schwabe (2000) conclude:

- "While these methods [CVM and TCM] are widely used, it is important to stress that none of the approaches mentioned is without its flaws. Indeed, there is continual debate on the validity and tractability of each method…
- "There is little uncertainty that wildlife-human conflicts impose significant costs on society. Yet, as most wildlife managers, hunters, and nature enthusiasts would agree, there is also enormous value associated with these same wildlife resources."

1.13.5 What are the Economic Results of the Marin County CA Predator Damage Replacement Program Compared to the WS-California Program?

1.13.5.1 What is the Marin County Predator Damage Replacement Program?

In 2001, Marin County, California, located north of the San Francisco Bay, created a program for protection of commercial sheep enterprises, called the Marin County Livestock Protection Program. This program redirected the funding Marin County previously spent on an IPDM contract with WS-California to a County-run cost-share program reimbursing producers for exclusion and other non-lethal method expenses. The program originally involved: 1) monetary reimbursement to ranchers for their costs associated with creating protective facilities and improvements such as fencing, guard dogs, and scare devices; and 2) indemnification – compensation for livestock lost to predation, using market price/head lost.

Under the current Marin County Livestock Protection Program, qualified ranchers are provided cost-share funding to assist in the implementation of non-lethal management methods to reduce depredation such as new fence construction or improvements to existing fences, guard animals, scare devices, or changes in animal husbandry (herders and shed lambing). The most commonly used methods by producers are guard dogs and fencing (Larson 2006). To qualify for the program, ranchers must have at least 25 head of livestock and must use two non-lethal methods to deter predation, as verified by the Marin County Agricultural Commissioner (Larson 2006). The Marin County program provides an opportunity for cost recovery to enrolled landowners for the purchase or maintenance of non-lethal or exclusionary equipment or maintenance or purchase of guardian animals. The program requires receipts be turned in for supplies/equipment purchased and/or proof of maintenance projects or guardian animals be otherwise documented with the Agricultural Commissioner, but does not require reporting of application of non-lethal or non-lethal methods, resource protection numbers, predation losses, or any other measure of success. The amounts available to producers have varied throughout the program with up to $3000 being available to large sheep operations (those with more than 200-300 ewes) and from $500 to $1500 available to smaller producers (Larson 2006).

Initially, producers who qualified for the program could also receive compensation for sheep and lambs lost to predation. However, when the Marin County Department of Agriculture, in a December 2014 California Public Records Request, was asked for records reflecting whether and to what extent the Program addresses or pays for the depredation by native predators, feral swine (wild hogs and boars), free roaming and/or feral dogs, and other common wild animals, Marin County indicated that the Livestock Protection Program was only a cost-share program which provided limited funds for purchasing fencing materials and guard animals. There are differing accounts as to why the indemnity portion of the program was discontinued. (Larson 2006) stated that the program was unable to pay the cost of all losses to predation and, in 2003, compensation payments were capped at 5% of the number of adult animals in the herd. In contrast, statements from the Marin County Agricultural Commissioner have attributed the change in program funding as a response to producer feedback requesting the County prioritize prevention over indemnity. Regardless of the reasons, the indemnity portion of the program has been discontinued.

1.13.5.2 How Do the Costs of the Marin County Program Compare to WS-California Program?

A review of Marin County's budget over the first five years of the non-lethal program's implementation found that on average the program cost Marin County 1.3 times the amount that the cooperative APHIS-WS IPDM program cost the county in its highest year (Larson 2006). Marin County's annual cost has ranged from a low of $5400 in FY2011–FY2012 to a high of $50,354 in FY2002-FY2003. The average annual cost of the Marin County Livestock Protection Program from 2001-2015 was $28,349 (Larson 2006). This budget evaluation only recorded the county's cost for implementation, and did not capture the additional landowner costs associated with this program. This cost estimate is for a program limited to providing financial compensation assistance with non-lethal predator damage management to protect livestock and poultry operations larger than a certain size. It does not provide trained personnel to apply this cost-shared equipment in the field or address several of the WS-Montana needs for action as identified in Chapter 1, including protecting smaller herds of livestock, property protection, work at airports, or for public/pet health or safety (Sections 1.11.2 through

1.11.5), nor do non-lethal methods always resolve the predator management problem, even for operations that do qualify for cost-share assistance.

1.13.6 What are Economic Concerns Commonly Expressed by Public Commenters to APHIS-WS IPDM EAs?

Commenters often request economic analyses that incorporate the combination of the economic contributions of resource and agricultural protection programs and the economic contribution of wildlife-related recreation and values of the existence of wildlife, especially predators, on ecosystem services and recreation opportunities. Aspects of these values are included in this EA in the evaluation of impacts to target and non-target populations (Sections 3.5 and 3.7), ecosystem services and biodiversity (Section 3.8), [sociocultural/wildlife values] and impacts to the recreation experience (various sections of Section 3.10).

Commenters to APHIS-WS IPDM EAs commonly express concerns about the economic costs of IPDM in relation to the economic values being protected, especially values related to livestock, and whether the use of public funds are appropriate to support private profits. These are discussed here and several are included in Section 2.5, Alternatives Not Considered in Detail.

1.13.6.1 Use of Taxpayer Funds for Private Profit, Livestock Losses Considered a Tax Write-off, and Livestock Losses Should Be an Accepted Cost of Doing Business

Some people and groups have commented that they do not want APHIS-WS to use taxpayer funds to benefit private commercial enterprises, such as livestock operations, and that producers should consider their losses to predators as a cost of doing business. Some believe that producers receive sufficient tax write-offs for their predation losses.

The national policy of using taxpayer dollars for subsidizing private or commercial profit, such as for protecting livestock from predators on private or public lands is established by Congress through statutes such as the Federal Land Policy and Management Act (FLPMA), the Multiple Use-Sustained Yield Act (MUSYA) requiring multiple use of federal lands, including for livestock grazing, and the APHIS-Wildlife Services authorizing act (Section 1.5.1), and Congressional appropriations. As wildlife belongs to the American public and is managed for many uses and values by tax-supported state and federal agencies, it is national policy that some of the resolution of damage caused by those same species is also publicly supported. Federal and state funds also support research and management of wildlife-related diseases, especially those that can be transmitted to livestock, pets, and humans. Furthermore, APHIS-WS is a cooperatively funded program, and WS-Montana is also funded by private and commercial entities that request its services.

APHIS-WS is not involved in establishing or approving national policies regarding livestock grazing on federal lands or supporting private livestock operations, but provides federal leadership in resolving wildlife-human conflicts and supporting coexistence of wildlife and humans. It is publicly accountable for the work that is requested by public and private entities and landowners, state and federal governments, tribes, and the public, and all activities are performed according to applicable laws and its mission and policies.

WS-Montana is aware of beliefs that federal wildlife damage management should not be allowed until economic losses become "unacceptable," (Section 1.4.3), and, conversely, that livestock losses should be considered as a cost of doing business by producers. WS-Montana receives requests for assistance when the operator has reached their tolerance level for damage or worries about safety and health, as well as in circumstances where the threat of damage is foreseeable and preventable. This tolerance level differs among different people and entities, and at different times. Although some losses can be expected and tolerated by agriculture producers and property owners, WS-Montana is authorized to respond to requests for assistance with wildlife damage management problems, and it is agency policy to respond to each requester to resolve losses, threats and damage to some reasonable degree, including providing technical assistance and advice. In some cases, responding to requests for assistance provides an overall benefit to the wildlife species causing damage. For example, swift, targeted responses to grizzly bear damage provide rural communities with a mechanism to coexist with this threatened carnivore thus building social tolerance in a landscape where grizzly bears were once persecuted. The Decision Model is used in the field to determine an appropriate strategy on a case-by-case basis. The APHIS-WS authorizing legislation does not require an economic analysis at any scale of operation (Section 1.5.1 and 1.13.1).

Some people believe that livestock producers receive double financial benefits when APHIS-WS provides services to producers because producers have a partially tax-funded program to resolve predation problems while they also receive deductions for livestock lost as a business expense on tax returns. However, this idea is incorrect because the Internal Revenue Service does not allow for livestock losses to be deducted if the killed livestock was produced on the ranch and not purchased from an outside source (Internal Revenue Service 2016). In the western United States, a large proportion of predation occurs to young livestock (lambs, kids, and calves), and many adult ewes, nannies, and cows are added as breeding stock replacements to herds from the year's lamb, kid, and calf crop. Any of these animals lost to predation cannot be "written off" since they were not purchased. These factors limit the ability of livestock producers to recover financial losses from predation through tax deductions.

This issue is appropriately addressed through political processes at the state and federal levels.

1.13.6.2 Compensation for Losses or Damage Should Replace APHIS-WS IPDM

Wildlife is typically managed by the state, regardless of land ownership. There is currently no national program to equitably distribute the costs of damage by predators covered in this EA between all consumptive and non-consumptive user groups. APHIS-WS does not have the authority to establish and/or administer such as program. The decision about how to distribute the costs of wildlife management is usually considered a component of state wildlife management decisions, except for those species managed by the USFWS.

Some states and counties have established programs that partially accept monetary responsibility for some types of wildlife damage (for example, (Bruscino and Cleveland 2004). Other states and counties have declined to establish such programs, presumably because they are satisfied with the current balance of the costs of managing predator damage.

As stated earlier, Montana's policy regarding compensation for losses of livestock to grizzly bears and wolves is set by state law (MCA §2-15-3112 and §81-1-111) and states:

> "The livestock loss board shall establish and administer a program to reimburse livestock producers for livestock losses caused by wolves and grizzly bears…. The board shall establish eligibility requirements for reimbursement, which must provide that all Montana livestock producers are eligible for coverage for losses by wolves and grizzly bears to cattle, swine, horses, mules, sheep, goats, llamas, and livestock guarding animals on state, federal, and private land and on tribal land… Confirmed and probable livestock losses must be reimbursed at an amount not to exceed fair market value as determined by the board. The legislature shall provide for a fund, to be known as the livestock loss reduction and mitigation trust fund, to be funded with gifts, grants, reimbursements, appropriations, or allocations from any source. "

In the most recent legislative session, state congress passed a bill (HB 286) allowing additional livestock loss compensation for mountain lion depredations. Montana has no other legal process for paying compensation for losses caused by any other predator, and the state obviously depends on the availability of funds for "required" compensation for losses due to grizzly bears, wolves, and now mountain lions.

The Agricultural Improvement Act of 2018 (aka the 2018 Farm Bill) authorized the Livestock Indemnity Program (LIP), which has provisions for the federal government to provide indemnity payments to eligible producers on farms that have incurred livestock death losses in excess of the normal mortality due to attacks by animals reintroduced into the wild by the federal government (such as wolves) or protected by federal law (such as animals protected under the Migratory Bird Protection Act or the Endangered Species Act). LIP is administered by the USDA Farm Services Agency, A USDA agency with a wholly separate mission and statutory authority than that of APHIS and APHIS-WS. Per LIP, payments are equal to 75% of the market value of the applicable livestock on the day before the date of death. The FSA Deputy Administrator of Farm Programs or designee makes that determination. The Natural Resources Conservation Service (NRCS) administers the program and has determined in those states with other livestock depredation reimbursement programs, including Montana, Idaho, and Wyoming, they will not offer indemnity payments because producers could be double paid. The MLLB only makes payments on wolf, grizzly bear, and mountain lion depredations. Compensation through the LLB began for wolves in 2008, for grizzly bears in 2013, and for mountain lions in 2017. Raven and eagle depredations which occur in Montana are not compensated but would fall under the ILP.

Difficulties related to a compensation-only alternative extend beyond jurisdictional challenges. Reviews of compensation programs indicate that these programs do not generally improve people's tolerance of the species causing damage (Treves et al. 2009) and do not address indirect costs of wildlife damage (Steele et al. 2013). Compensation programs for recovering wildlife species can, in some cases, increase to the point where funds needed for compensation undermine budgets for conserving other species (Treves et al. 2009). Some authors have raised concerns that compensation programs may make producers less risk-averse and less likely to adopt new or improve existing management practices. Bad managers may be compensated at the expense of those who invest in good management techniques. The challenges of designing and managing compensation schemes are so intensive that managers seldom evaluate the overall cost-effectiveness in comparison to the benefits (Nyhus et al. 2003, Bulte and Rondeau 2005, Treves et al. 2009). Treves et al. (2009) suggest that compensation does not necessarily improve tolerance for depredating wildlife, and some producers may reject payments in favor of lethal control. For these reasons, WS-Montana believes that establishing a compensation program for predator damage administered by WS-Montana is not feasible, and that this issue is appropriately addressed through political processes at the state and federal levels.

1.13.6.3 Livestock Producers Should Pay All Costs of IPDM

The Act of 1931, as amended, authorizes the Secretary of Agriculture to make expenditure of resources for the protection of agricultural resources. Congress makes annual allocations to APHIS-WS for the continuing federal action of IWDM, including IPDM. Congress further establishes that APHIS-WS may receive and retain funds provided by other entities (e.g., states, industry, public and private funds) and use them towards those programs from which funds were received. WS-Montana's funding is made up of about 58% Congressional appropriations, 16.8% state agreements (includes 12.9% from state per capita tax paid per head by livestock producers to MDOL), and 22.3% livestock producers, 2% environmental organizations, 0.9% sportsmen's associations. With the exception of an electric fencing cost-share program in occupied grizzly bear habitat funded by Defenders of Wildlife, cooperators pay the costs of non-lethal actions taken, even when recommended by WS-Montana personnel, and a substantial proportion of the cost for WS-Montana efforts, including administrative overhead.

This issue is appropriately addressed through political processes at the federal levels.

1.13.6.4 WS-Montana Should Subsidize Non-lethal Methods Implemented by Resource Owners

WS-Montana is a cooperatively funded program with approximately half of its funding comprised of non-appropriated (non-federal) dollars. Cooperators provide direction to WS-Montana on the types of services they want delivered with the funding they provide and it is implemented in accordance with program policies. Using cooperative funding provided by MLLB and equipment provided by Defenders of Wildlife, Natural Resources Defense Council, and People and Carnivores, WS-Montana collaborated with these organizations to put up 22 turbo fladry projects between 2016 and 2018. In 2017 and 2018, WS-Montana built 9 electric fences to protect sheep, cattle, and beehives from damage by bears and wolves. Between 2015 and 2018, WS-Montana hosted 5 workshops to share information with livestock producers on methods to prevent conflicts between livestock and predators and presented at 2 beekeeper association meetings. Recently, WS-Montana received cooperative funding to hire two non-lethal only, seasonal field specialists. The first position, which began in early 2018 is focused on outreach and tools, such as fences, to physically exclude predators from livestock. A range rider was hired for the second position, which began in mid-2018, to protect cattle on summer grazing allotments from wolf depredations. WS-Montana also loans temporary electric fencing (turbo fladry) and harassment equipment under very specific circumstances. This equipment is also purchased with cooperative funds dedicated to conflict prevention, and the new non-lethal only positions have increased the ability of WS-Montana to install this equipment in the field. Cooperators also rely on WS-Montana to provide technical assistance needed for individuals to use their own resources and efforts. Use of appropriated (federal) dollars to subsidize the purchase of non-lethal methods would impact the support infrastructure which enables other entities to cooperate with WS-Montana.

The State of Montana also subsidizes a small number of non-lethal projects through the MLLB. Grants for non-lethal projects are issued after all losses are compensated by the MLLB; therefore, the number of compensations directly determine how much assistance is available for non-lethal projects. Defenders of Wildlife also offers a cost-share program to install electric fencing in occupied grizzly bear habitat. Subsidies for use of non-lethal methods to selected types of livestock producers is currently offered in Marin County, California by the County to some degree, but the costs and effectiveness are not clearly known (Shwiff et al. 2005) (Shwiff et al. 2006); Sections 1.13.5 and 2.5.25).

This issue is appropriately addressed through political processes at the state and federal levels.

1.13.6.5 Incorporate the Environmental Costs of Livestock Grazing on Public Lands into Cost Analyses

Commenters have requested that APHIS-WS consider the environmental costs of grazing on public lands and other activities in cost analyses. As stated earlier, APHIS-WS has no authority to address national policy set by multiple Congressional statutes regarding livestock grazing on federal lands, nor annual appropriations related to livestock grazing and other uses on public lands, or private lands, for that matter. APHIS-WS only responds to requests for assistance, and uses the Decision Model to determine appropriate responses, considering factors that include social and environmental considerations and the specific circumstances and species associated with the damage, in addition to efficacy and costs.

Therefore, this issue is not pertinent to APHIS-WS decision-making, and is appropriately addressed through the political process at the Congressional level.

1.13.6.6 APHIS-WS Should Be Financially Liable for Pet Dogs that Are Incidentally Killed During Operations

Concerns are also raised over WS-Montana field personnel possibly incidentally taking pet dogs while attempting to take another target species. APHIS-WS Directive 2.340 states: "Where WS personnel determine that a captured dog is a pet, WS personnel shall inform the land/resource owner as soon as is practicable….This policy does not in any way preclude WS personnel from appropriately defending themselves, their working animals, or restrained animals captured pursuant to official WS actions, from dog attacks." WS-Montana field personnel take appropriate actions to avoid incidental take of pet dogs and do not set devices that could capture dogs in recreational areas whenever possible. All capture traps are set to minimize the risk of damage to the animal (Section 2.4 and 3.9). If the dog has identification allowing determination of the owner, the owner is informed as soon as possible. If not, then the dog is released on site. There is no legal authority for financial liability against APHIS-WS personnel when operating consistent with federal and state law and APHIS-WS Directives.

1.13.6.7 PDM Should be Funded Through a State Head Tax

By statute, a livestock head tax for funding PDM has been established by the MDOL assessing per capita fees for livestock (http://liv.mt.gov/Centralized-Services/Per-Capita-Fees) under statutory authority (MCA §81-1-102). Currently, 5% of per capita fees go to WS-Montana for IPDM in the state.

In addition, Montana state law allows individual counties to pass sheep and/or cattle petitions raising additional funds to support IPDM when 51% or more of the sheep or cattle owners agree (MCA §81-7-305, §81-7-603, and §81-7-605). Sheep producers have passed petitions in 46 of the 53 cooperating counties in Montana; 27 out of 53 cooperating counties have passed cattle petitions or special livestock petitions. One county pays WS-Montana for IPDM directly through general county funds. This funding collectively pays for 22.3% of the WS program in Montana.

This issue is appropriately addressed through the political process at the state or county level.

2 Alternatives and Alternatives Not Considered in Detail

2.1 What is Included in this Chapter?

This chapter describes:

- Detailed descriptions of the five WS-Montana IPDM alternatives evaluated in detail in Chapter 3, including the current WS-Montana IPDM program (no action alternative) and various levels of WS-Montana involvement in IPDM activities in Montana;
- APHIS-WS directives (USDA Wildlife Services 2018c) and associated protective measures that WS-Montana must follow, and state laws and regulations that all those involved in management of predator damage and who take wildlife lethally for a variety of purposes, including private citizens, must; and
- IPDM alternatives that are not evaluated in detail in this EA, with rationale.

2.2 What Alternatives Are Considered in Detail in this EA?

The following alternatives are evaluated in detail in this WS-Montana IPDM EA.

Alternative 1: Proposed Action/No Action Alternative - Continue WS-Montana IPDM Assistance, with reasonable fluctuations in program delivery, and lethal and non-lethal operational and technical support.

Alternative 2: WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance . WS-Montana could provide lethal and non-lethal technical assistance, and/or non-lethal operational assistance, but would not provide lethal operational assistance.

Alternative 3: WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance. WS-Montana would provide both technical assistance and operational assistance, but reasonable application of non-lethal methods would have to be shown ineffective to resolve the damage/threat before WS-Montana could take lethal action. WS-Montana would not provide proactive lethal assistance, and lethal assistance could not be taken until WS-Montana has confirmed and recorded that reasonable non-lethal actions have not resolved the problem.

Alternative 4: WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species.

WS-Montana provides full IPDM assistance, including lethal and non-lethal assistance, only when requested for protecting human/pet health or safety, when eradicating invasive feral swine, or to protect federally-listed species; all other assistance would only use non-lethal methods and/or technical assistance.

Alternative 5: No WS-Montana IPDM Activities. WS-Montana would not conduct IPDM activities in Montana. IPDM would still be implemented by other legally authorized entities, such as MFWP, MLLB, USFWS, property owners, non-governmental organizations (e.g. NRDC and Defenders of Wildlife), and commercial IPDM companies.

2.3 What WS-Montana Activities Are Included in Each Alternative?

The five alternatives are described in detail below. The effectiveness of each of these alternatives in addressing WS-Montana IPDM objectives (Section 1.5.2) is evaluated in Section 3.14). Alternatives that were determined not to be reasonable, practical, or effective are described in Section 2.5, with the rationale provided for not evaluating each one in detail. Protective measures, APHIS-WS policies, and relevant state laws and regulations for addressing the issues are identified in Section 2.4 after the description of the alternatives and incorporated into all alternatives as applicable that include WS-Montana activities.

2.3.1 Alternative 1. Continue the Current Federal Integrated Predator Damage Management Program (No Action/Proposed Action)

2.3.1.1 Why is the Proposed Action Also the "No Action" Alternative?

In its 40 Most Asked Questions regarding the consideration of the "no action" alternative for project- and programmatic-level NEPA reviews, Council on Environmental Quality (1981b) states:

> "In situations where there is an existing program, plan, or policy, CEQ expects that the no-action alternative …would typically be the continuation of the present course of action until a new program, plan or policy is developed and decided upon (40 Fed. Reg. 18026, March 23, 1981)."

Some commenters to prior EAs have interpreted the "no action" alternative to be an alternative in which no action is taken by the federal Agency. However, APHIS-WS is required to follow CEQ guidance on this topic. Therefore, the current program, with natural fluctuations in IPDM actions, locations, and tempo, is also the "no action" alternative. The impacts of all other alternatives considered in detail will be compared to the impacts of the current program.

2.3.1.2 How do WS-Montana Field Personnel Select an IPDM Strategy Using the APHIS-WS Decision Model?

For all alternatives in which WS-Montana provides requested services, WS-Montana uses the APHIS-WS Decision Model (Figure 2.1)(Slate et al. 1992, USDA Wildlife Services 2014b) as part of IPDM for evaluating the situation and determining the most effective strategy to address the situation.

Under the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b), APHIS-WS field personnel assess the problem and evaluate the appropriateness of available damage management strategies and methods based on biological, economic, and social considerations. Following this evaluation, methods deemed to be practical and effective for the situation are incorporated into a management strategy. After the selected strategy has been implemented, the property owner monitors and evaluates the effectiveness, sometimes with APHIS-WS assistance. If needed, management strategies are then adjusted, modified, or discontinued, depending on the results of the evaluation.

The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) includes the following steps (Figure 2.1):

1. **Receive Request for Assistance:** WS-Montana only provides assistance after receiving a request for such assistance. The WS-Montana specialist can respond by providing professional technical assistance, information, recommendations, and advice at any time, on-site or through verbal or written communication. If the requester needs further on-site active assistance, the WS-Montana specialist and the requester will agree to the level of service and enter into a work agreement.
2. **Assess Problem:** Once on site, the WS-Montana field specialist makes a determination as to whether the assistance request is within the authority of WS-Montana. If an assistance request is determined to be within agency authority, the specialist gathers and analyzes damage information in the field to what species was responsible for the damage and the type, extent, and magnitude of the damage. Other factors that WS-Montana's employees often consider include the current economic loss or current threat, such as the threat to human safety, the potential for future losses or continued damage, the local history of damage in the area, environmental considerations, and what management methods, if any, were used to reduce past damage and the results of those actions.
3. **Evaluate Management Methods:** Once a problem assessment is completed, the field specialist conducts an evaluation of available management methods to recommend the most effective strategy, considering available methods in the context of their legal and administrative availability and their acceptability based on biological, environmental, social, and cultural factors.
4. **Formulate Management Strategy:** The field specialist formulates a management strategy using those methods that the employee determines to be practical and effective for use, considering additional factors essential to formulating each

management strategy, such as available expertise, willingness of the property owner, legal constraints on available methods, costs, and effectiveness.

5. **Provide Assistance:** After formulating a management strategy, technical assistance and/or direct operational assistance is provided as appropriate.
6. **Monitor and Evaluate Results of Management Actions:** When providing direct operational assistance, effectiveness of the management strategy is monitored, primarily by the cooperator, with assistance by WS-Montana when appropriate. Monitoring is important for determining whether further assistance is required or whether the management strategy resolved the problem and if additional work is necessary.
7. **End of Project:** When providing technical assistance, a project normally ends after the WS-Montana field specialist provides recommendations. Direct operational assistance ends when WS-Montana's field specialist is able to eliminate or reduce the damage or threat to acceptable levels. Some damage situations may require continuing or intermittent assistance from WS-Montana and may have no well-defined termination point, as work must be repeated periodically to maintain damage at low levels.

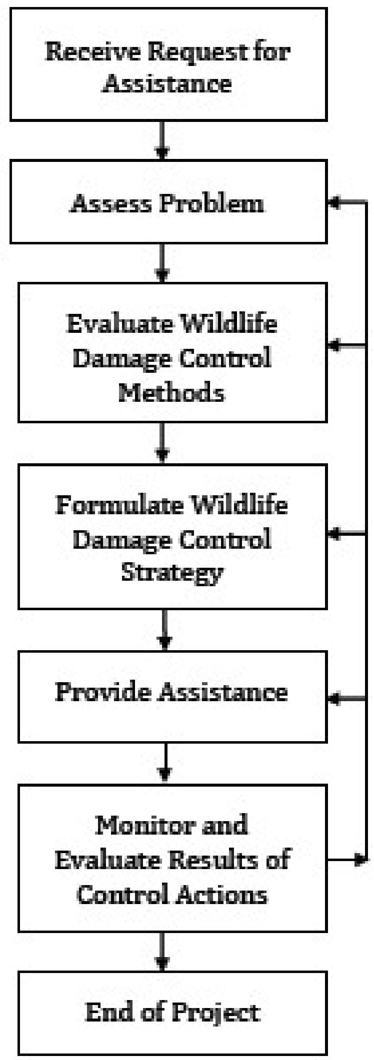


Figure 2.1. APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b)

What is the Process for Verifying Losses and Damage?

Conflicts with predators take the form of a threat of damage, such as a history of predation of livestock in an area, and/or damage that has or is currently occurring. Damage reported to WS-Montana, such as predation or injury, is recorded in the APHIS-WS MIS database as "reported" damage. If employees are able to verify that the damage occurred, it is recorded in MIS as "verified" damage (defined as resource or production losses examined by a WS-Montana specialist during a site visit and determined to have been caused by a specific predator species). Confirmation of the species that caused the damage and the extent of the problem are important steps toward establishing the need for implementing the IPDM activities and the methodologies that will be most effective to resolve the problem.

Several factors can increase the complexity of determining whether a depredation event occurred and, if so, which species is responsible for the damage. Responding to a request in a timely manner is critical in order to examine evidence, such as signs of a struggle,

hair, scat, tracks, or wounds on an animal, which may be indicative of a particular predator's method of attacking livestock or wild animals. Many factors, including consumption of the remains from a predator or other scavengers, natural decomposition, and local climate variables, can impact the condition of the livestock remains and make it harder for WS-Montana personnel to determine the predator species responsible.
Field employees carefully examine the surrounding area and often perform a field necropsy to observe or collect evidence, such as bite/claw marks, trauma, and hemorrhaging. Natural causes of death, such as injury, illness, and animal health are also considered during the necropsy.

The location of the dead animal and how it is oriented can help determine the offending species, because predator species have typical patterns or ways that they kill their prey. Occasionally there is sufficient evidence to conclude that depredation did occur, but insufficient information to make a determination as to which predator species was involved. For example, there may have been visual signs of a struggle, blood trails, or tissue showing signs of hemorrhaging insufficient to know which species caused it. The predator and, potentially, scavengers may eat most of the carcass. When insufficient evidence remains to verify depredation, the loss is considered to be *reported* and the species most likely to have cause the damage is recorded in the MIS database. WS-Montana can then take appropriate action in accordance with APHIS-WS policy and state and federal law.

In most cases, when addressing livestock predation, WS-Montana field personnel do not attempt to locate every depredated carcass reported by ranchers, but attempt to verify sufficient levels of damage to establish the need to take action and develop the appropriate strategy using the WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b). Therefore, in many cases damage reported by WS-Montana does not actually reflect the total number of livestock or other resource affected, but provides an index of the annual damage occurring and sufficient information to develop the management strategy. Since producers experiencing loss may or may not contact WS-Montana to report their losses or to request assistance, even fewer instances of depredation are documented. Producers often try to resolve the damage themselves or may request the assistance from other entities, such as commercial companies permitted by MLLB (Section 1.7).

2.3.1.3 Background to the Proposed Action/No Action Alternative

The Proposed Action/No Action alternative continues the current implementation of an adaptive integrated predator damage management (IPDM) approach utilizing non-lethal and lethal techniques (Appendix A), identified through use of the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b), to reduce damage and threats caused by predators in Montana.
A major goal of the WS-Montana program is to resolve and prevent damage caused by predators and to reduce threats to human safety. To meet this goal, WS-Montana continues to respond to requests for assistance with Technical Assistance and/or operational assistance to entities that enter into a Cooperative Service Agreement.
APHIS-WS activities are authorized by The Animal Damage Control Act of 1931 (as amended) and are funded by both Congressional appropriations and funds provided by

entities that enter into agreements with APHIS-WS state offices. For WS-Montana activities (not including feral swine), this funding is made up of 53.7% Congressional appropriations, 16.6% state agreements (includes 12.0% from per capita taxes paid per head by livestock producers to Montana Department of Livestock (MDOL)), 21.1% from livestock producers, 1.8% from environmental organizations, 1.0% from sportsmen's associations, and 4.8% from additional service agreements not related to PDM. Montana state law allows individual counties to pass sheep and/or cattle petitions raising additional funds to support IPDM when 51% or more of the sheep or cattle owners agree (MCA §81-7-305, §81-7-603, and §81-7-605). Sheep producers have passed petitions in 46 of the 53 cooperating counties, and 27 out of 53 cooperating counties have passed cattle petitions or special livestock petitions. One county pays WS-Montana for PDM directly through general county funds. This funding collectively pays for 21.4% of the WS program in Montana. The presence of a WS-Montana employee in any given county may be dependent on that county providing financial support.

To be most effective, damage management activities should begin as soon as predators begin to cause damage or are expected to begin to cause damage, such as in the spring during coyote pupping while livestock are simultaneously lambing or calving. Waiting until damage is ongoing may make the problem more difficult to resolve since individual animals become conditioned to an area and familiar with a particular location. For example, the method of making an area with vulnerable livestock unattractive can be difficult to achieve if damage has been ongoing. WS-Montana works closely with those requesting entities to identify situations where damage could occur. WS-Montana personnel implement or recommend effective non-lethal and/or lethal damage management activities as early as possible in order to increase the likelihood of those methods achieving the appropriate level of damage reduction. In Montana, while coyotes, red fox, skunks, raccoons, badgers, and feral swine can all be taken by proactive lethal damage management activities, coyotes and red fox are the only predator species typically taken by proactive lethal damage management activities. Any removals must be consistent with federal and state laws and regulations, including take reporting requirements.

Under this alternative, WS-Montana, in consultation with MFWP and/or USFWS when appropriate, will continue to respond to requests for assistance by:

- Taking no action if warranted;
- Providing non-lethal and/or lethal technical assistance to property owners or managers on actions they could take to reduce damages caused by mammals; or
- Providing non-lethal and lethal operational assistance and, when appropriate, technical assistance to a property owner or manager.

WS-Montana also continues to work with the USDA, APHIS, Wildlife Services National Wildlife Research Center (NWRC) to study effectiveness and make improvements to various IPDM methods. WS-Montana also works with MFWP, Defenders of Wildlife and Natural Resources Defense Council, and other agencies and cooperators to distribute materials, provide educational programs on methods for preventing or reducing predator damage, erect fences to deter predators from livestock, and hire range riders to establish human presence on grazing allotments with a history of predation by grizzly bears and wolves.

2.3.1.4 What are the General Components of WS-Montana Activities in Alternative 1?

The current WS-Montana wildlife damage management approach includes the following general components (Appendix A):

- **Collaboration and Project Identification**

APHIS-WS state programs enter into cooperative partnerships in all aspects of operational wildlife damage management when requested by agency partners, tribes, and private entities. Cooperative partnerships may be developed to implement predator damage management activities in targeted areas and for targeted resource protection, such as agricultural areas, areas with threatened or endangered species and other natural resources, urban/suburban areas to reduce property damage, or to protect human health and safety (Sections 1.11.2 through 1.11.6). For example, a group of cattle producers in northwest Montana concerned about wolf depredations on summer grazing allotments approached MFWP about their desire for a range rider. MFWP and WS-Montana worked together to find three additional conservation-based NGO collaborators and funding for the project which resulted in a seasonal WS-Montana range rider position.

- **Education and Training**

WS-Montana provides professional courses and training to agencies, organizations, the public, property owners and managers, and cooperators upon request on wildlife management and biology, wildlife damage management, and non-lethal and lethal techniques for managing the risk of damage to encourage co-existence. Many APHIS-WS personnel, including scientists at the NWRC, publish professional papers and speak at conferences and meetings to further the science and application of wildlife damage management.

- **Technical Assistance**

Property owners or managers requesting assistance from WS-Montana are provided with information on non-lethal and lethal techniques and/or IPDM strategies, including advice, training, and, to a limited degree, loan of equipment. Technical assistance training can be over the phone, on-site, or in instructional meetings. WS-Montana provides training on depredation investigations related to human health and safety to MFWP, law enforcement, and other officials. Additionally, WS-Montana provides training to the public on how to avoid wildlife conflict and conducts workshops on non-lethal methods for producers and resource owners. Since 2015, WS-Montana has conducted 6 workshops at various locations throughout Montana dedicated to conflict prevention with methods including carcass composting, turbo fladry, electric fencing, and range riders discussed by local experts on the topics. Technical assistance is described in detail in Appendix A.

- **Operational Assistance**

WS-Montana wildlife damage management activities involve an IPDM approach using a range of non-lethal and lethal techniques which can be used singly or as part of an IPDM approach.

Property owners or managers may choose to take lethal management action themselves when authorized by law (*e.g.* MCA §87-6-106 and §81-29-103) without consulting another private or governmental agency. While this state law will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (see 40 CFR 31734, July 28, 1975) supersede this state law. They can also use contractual services of private businesses, use volunteer services of private organizations, requests assistance from MFWP, request to use the services of WS-Montana (direct operational assistance), or take no action.

- **Preventive (Proactive) Damage Management**

USDA APHIS defines Preventive Damage Management as: “applying management strategies before damage occurs, based on historical problems and data. Many resource management strategies and physical exclusion methods are intended to prevent damage from occurring. For example, fencing is often used to keep predators out of livestock pastures to prevent predation. When requested, WS personnel provide information and conduct demonstrations, or take action to prevent future losses from recurring.”

Preventive IPDM is a strategy that applies lethal and/or non-lethal IPDM action before expected damage occurs, based on historically recurring problems. Most non-lethal methodologies, whether applied by WS-Montana or resource owners, are used to prevent damage from occurring and therefore fall under this category of IPDM methods. When requested, WS-Montana personnel can provide information, conduct demonstrations, or take direct action to prevent additional losses from recurring.

For example, in areas where substantial livestock depredations have occurred on lambing or calving grounds in the past, WS-Montana has provided technical assistance in the form of information about livestock guarding animals, fencing, or other husbandry techniques. In areas with recurrent wolf depredations, WS-Montana works with landowners to install turbo fladry (red flags sewn onto electrified polywire) to deter wolves from vulnerable livestock. Additionally, if requested and appropriate, WS-Montana may conduct lethal predator management by removing multiple predators in a specific area before lambing or calving begins in an attempt to preemptively prevent continued depredation.

The rationale for conducting preventive damage management differs little in principle from holding controlled hunts for deer or elk in areas where agricultural damage has been a historical problem. By reducing the number of predators, specifically coyotes, operating in a territory near livestock, the risk of damage at the time is potentially reduced. Rather than requesting assistance from WS-Montana, property owners may conduct such activities on their own property (MCA §81-7-505 and §81-29-103) or request commercial companies with MDOL permits for aerial depredation to conduct such activities (MCA §81-7-501).

- **Corrective (Reactive) Predator Damage Management**

USDA APHIS defines Corrective Damage Management as: “applying management strategies to stop or reduce current losses. As requested and appropriate, WS personnel provide information, conduct demonstrations, or take action to prevent future additional losses. Corrective actions may include a combination of… wildlife damage management approaches, technical assistance, and operational damage management assistance".

When appropriate, WS-Montana also provides damage management assistance (operational assistance) using lethal and non-lethal methods within an IPDM strategy. Resource managers and others requesting operational assistance are provided with information regarding the use of effective non-lethal and lethal techniques, including recommendations as to effective long-term strategies for reducing risk of wildlife damage.

For example, in areas where verified livestock depredations are occurring, WS-Montana field specialists may provide information about livestock guarding animals, fencing or husbandry techniques, and/or conduct operational, often lethal, damage management activities to stop the losses.

When deployed many lethal and non-lethal methods are intended to be short-term or long-term attempts at reducing damage currently occurring. They can also be used to prevent damage from reoccurring in areas with historical damage. However, these methods cannot ensure predators do not return once those methods are discontinued. Property owners may also request commercial companies with MDOL permits for aerial shooting and or conduct such activities themselves rather than requesting assistance from WS-Montana.

- **Carcass Disposal**

Unless otherwise regulated by Montana law, WS-Montana disposes of carcasses by moving them out of view (e.g., into a brush pile), placing them in existing carcass pits on private property, or occasionally disposing of them in designated landfills or transfer stations when other methods are not feasible or available. Animals taken during aerial operations are seldom if ever recovered because it is not always safe to land aircraft in the field, and it is seldom cost or time-effective to make multiple landings during a flight. Also, aircraft have weight restrictions that control transportation of extra cargo for safety reasons, which is especially critical for low-level flights.

The Administrative Rules of Montana (ARM) regulating the disposal of carcasses of animals include: disposal of carcasses (ARM 32.3.125 and 32.4.1002), materials prohibited from open burning (ARM 17.8.604), and types of wastes (ARM 17.50.503). MCA 81-2-108 provides further regulations on the disposal of carcasses of animals which died or were suspected to have died from an infectious disease.

In addition, all disposal of carcasses is consistent with APHIS-WS Directives (USDA Wildlife Services 2018c) and state law.

- **Monitoring**

WS-Montana, in coordination with MFWP and/or USFWS when appropriate, monitors the results and impacts of its program. The impacts discussed in this EA are monitored and evaluated in two ways:

> 1) WS-Montana determines if any additional information that arises subsequent to the NEPA decision from this EA would trigger the need for additional NEPA

analysis. WS-Montana reviews implementation results and the related NEPA documents as needed to ensure that the need for action, issues identified, alternatives, regulatory framework, and environmental consequences are consistent with those identified.

2) WS-Montana, in coordination with MFWP and/or USFWS when appropriate, monitors impacts on target and non-target predator populations through its MIS database. The MIS information is used to assess the localized and cumulative impacts of WS-Montana activities on specific target predator and non-target wildlife populations. WS-Montana provides detailed information on animals removed, as appropriate, to MFWP and/or USFWS to assist those agencies with managing species and resources under their jurisdictions.

2.3.1.5 What Types of Actions are Included in Alternative 1?

Alternative 1 continues the current WS-Montana IPDM assistance as requested, accounting for inherent, realistic fluctuations in program delivery.

Most requests for IPDM assistance come from private resource owners, particularly livestock operators, who may utilize private and/or public lands for grazing during some part of each year.

WS-Montana also receives requests for IPDM assistance to protect other assets, such as:

- Agricultural resources other than livestock from private entities;
- Domestic pets and personal and commercial structures or properties;
- Human health and safety, from private and government entities.

Most of these requests come from private individuals. However, requests for assistance may also come from public entities, such as MFWP, MDOL, MLLB, and other local, state, federal, or tribal entities. IPDM assistance provided by WS-Montana personnel may be conducted on public, private, state, tribal, and other lands or any combination of these land class types, as appropriate (Section 1.8 and Table 2.2).

APHIS-WS has signed national level MOUs with BLM, USFS, and the USFWS. In addition, WS-Montana has signed agreements with MFWP, MDOL, MLLB, the Confederated Salish and Kootenai Tribes, and the Blackfeet Nation to provide wildlife damage management services upon request (Sections 1.8 and 1.9). Usually, requests for management work on BLM and USFS land come from the livestock permittees. All anticipated WS-Montana activities on USFS and BLM lands are outlined in WS-Montana Annual Work Plans for each National Forest and BLM area of interest, usually grazing allotments. When work is proposed, annual coordination meetings are held between WS-Montana and personnel from the land management agencies to discuss accomplishments, status of work, issues of concern, and any anticipated changes in proposed work plans.

2.3.1.6 In What Types of Areas Would WS-Montana Operate?

These areas include sites/locations where IPDM is anticipated to continue to occur or reoccur and WS-Montana has been requested to actively work or is considering accepting work. These planned activities are those that are covered under existing Cooperative

Service Agreements or are identified along with planned management areas in Annual Work Plans with the USFS or BLM. Livestock depredation control work is mostly concentrated in areas where livestock are most abundant and during times when they are most vulnerable to predators such as during calving and lambing. Requests for assistance in reducing property damage, and threats to human/pet health and safety are by their nature intermittent and thus less predictable in time and geographic location.

Under the current WS-Montana activities, the frequency, locations, cooperators (private, state, federal, tribal and others), varieties of IPDM work, and numbers of target and non-target animals taken have varied over the years. WS-Montana expects these degrees of variation to continue into the future, and, therefore, for the purposes of the impact analyses in this EA, sets reasonable outside bounds for these factors for continuing the current activities. WS-Montana recognizes that requests for its assistance are on a case-by-case basis. Regardless of the situation, the WS-Montana employees are trained and experienced, and they respond using APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) to determine whether a response is warranted and, if so, the most effective strategy (Section 2.3.1.2).

Therefore, this alternative includes IPDM actions within areas and locations in which WS-Montana has operated or would foreseeably operate, consistent with this EA upon request, even if those area are not currently under agreements (Figure 2.2).

Unforeseen areas of operation or currently unplanned activities, including emergency responses, are areas or locations where WS-Montana has not operated or had agreements to operate in which an entity experiencing predator damage, threats, or risks to human/pet health or safety requests assistance from WS-Montana. Unforeseen IPDM activities are handled on a case-by-case basis as the need arises, in response to a request. If IPDM is requested on lands classified as other than private, WS-Montana notifies the land management agency as soon as practicable or as agreed upon in MOUs.

This alternative includes WS-Montana conducting IPDM operations within currently unforeseen areas as long as the operations are consistent with actions and impacts as described in this EA, as applicable:

- Federal and state law and regulations;
- APHIS-WS policies and Directives (2018c);
- Lethal and non-lethal methodologies as described and applied according to this EA;
- The protective measures included in this EA;
- Federal land management plans and federal Annual Work Plans and state or tribal objectives and requirements, including those areas with special designations, such as wilderness areas and wilderness study areas;
- The results of formal and informal consultations with the USFWS per the ESA (Section 3.6);
- Sustainable population levels as evaluated in Sections 3.5 and 3.7; and

- The actions would not trigger substantive environmental issues or effects that are not addressed in this EA.

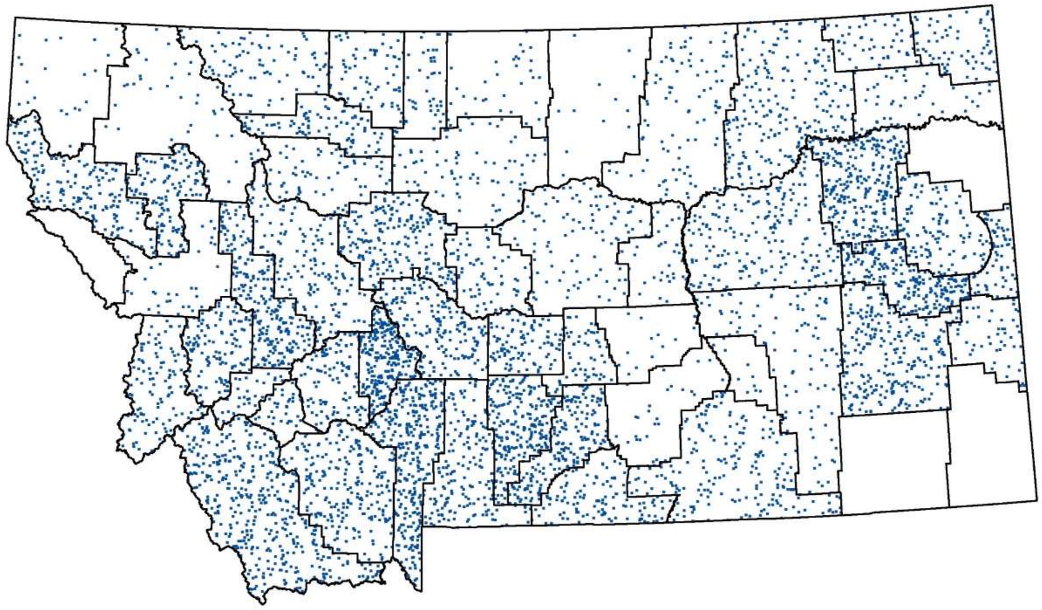


Figure 2.2. Counties within which WS-Montana has operated in the state, and within which it could respond to requests for assistance under Alternative 1. Randomized dots indicate the number of agreements in each county in fiscal year 2014. There are 3 counties (without dots) with which WS-Montana does not have cooperative agreements. In these counties, WS-Montana activities are restricted to investigations for loss compensation through the MLLB.

2.3.1.7 What Types of Methods Are Used in Alternative 1?

As detailed in Appendix A, WS-Montana can use and/or recommend many methods, including combinations of methods for IPDM strategies.

WS-Montana, MDOL-permitted aerial operators, or the property owners themselves may implement IPDM methods. Implementing non-lethal methods such as husbandry or structural barriers are generally the responsibility of the property owners; however, WS-Montana offers some operational assistance with non-lethal methods when resources are available and property owners are willing to participate in cost sharing programs. Similar programs are available from NGOs such as Defenders of Wildlife's electric fence incentive program in grizzly bear habitat. Depending on the circumstances of a particular IPDM situation, lethal methods may be needed to address the immediate problem during the time period while non-lethal methods are implemented. The design of the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) which provides for the consideration of lethal and non-lethal methods, allows WS-Montana to use and recommend the most effective and practical methods available, while accounting for the many legal, logistical, biological, ethical, and environmental variables in each unique damage situation.

Detailed descriptions of lethal and non-lethal methodologies are found in Appendix A; brief summaries are included below.

- **Non-lethal methods**

Non-lethal methods can be used to disperse, prevent or restrict access or otherwise make an area unattractive to predators causing damage, thereby reducing the risk that predators can cause damage or threats at the site and immediate area. As required by our Directives (USDA Wildlife Services 2018c), non-lethal methods are given priority by WS-Montana field specialists when addressing requests for assistance, where applicable and effective (USDA Wildlife Services 2018c). However, non-lethal methods are not necessarily used to resolve every request for assistance if deemed inappropriate or potentially ineffective by WS-Montana's personnel under the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) within the practices of IPDM (Section 2.3.1.2, Figure 2.1). WS-Montana personnel may recommend that lethal methods be used initially to resolve the immediate problem while non-lethal methods are implemented, such as fence construction.

Non-lethal methods used or recommended by WS-Montana may include habitat management, husbandry, hazing, fencing, turbo fladry, aversive/harassment devices, herding, and livestock guard animals (Appendix A). WS-Montana may occasionally loan fencing such as turbo fladry or harassment equipment such as propane cannons and pyrotechnics to livestock producers. In many situations, the implementation of non-lethal methods, such as construction of fencing, is the responsibility of the requestor to implement. Many of these methods require regular maintenance and/or human presence to be effective. For dispersing predators, proper timing is essential. Using methods soon after damage begins or soon after threats are identified increases the likelihood of success.

In most situations, a cooperating entity has already tried reasonable non-lethal methods to resolve damage prior to contacting WS-Montana for assistance. In those cases, the methods used by the requester were either unsuccessful or the reduction in damage or threats had not reached a level that was tolerable to the requesting entity. In those situations, WS-Montana could use other non-lethal methods, attempt to continue the use of the same non-lethal methods, and/or recommend or use lethal methods. Typically, the implementation of non-lethal methods, such as exclusion-type barriers, is the responsibility of the requester, which means that, in those situations, the only options available to WS-Montana field specialist involve the use of lethal methods, if determined to be appropriate and potentially effective under the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b).

- **Lethal methods**

After receiving a request for assistance and conducting a field review, trained and certified WS-Montana personnel may determine that lethal methods are appropriate. Lethal methods are often used to reinforce non-lethal methods, to remove animals that have been identified as causing damage or posing a threat to human safety, and/or to reduce the risk of depredation reoccurring in an area where it has occurred in the past. The use of lethal methods results in temporary and small local reductions of the numbers of predators in the area where damage or threats are occurring or are expected to reoccur. The number of animals removed from the area using lethal methods under this alternative is dependent on the number of predators involved with the associated damage or threat, the potential for reoccurrence of depredation, especially on livestock or ESA-listed species, and the effectiveness of methods used.

Lethal methods used by WS-Montana employees include ground shooting, aerial shooting, snaring, live trapping, such as using snares, nets, cage traps, and foothold traps (followed by mechanical or chemical euthanasia) or methods such as chemical toxicants when lawful. These methods are described in detail in Appendix A. WS-Montana employees follow the American Veterinary Medical Association (American Veterinary Medical Association 2020) euthanasia recommendations for free-roaming and captured animals in program activities, where practical and effective (Sections 2.4, 3.9, and 3.10.3.4), and use the most humane and rapid methods available under the circumstances and per the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b)(Figure 2.1, Section 2.3.1.2, Appendix A, and Section 3.9) and other USDA, APHIS, Wildlife Services directives (USDA Wildlife Services 2018c).

Aerial shooting with fixed-wing aircraft is generally one of the most effective control methods for managing livestock depredation by coyotes where terrain is relatively flat. It is the preferred method because of its selectivity, accessibility, effectiveness and ability to traverse rough terrain during winter weather. In addition, it provides the greatest area of coverage needed to protect livestock resources. Other control methods, such as foothold traps, snares, M-44s and ground shooting, are also used in combination with aerial shooting in these areas. During spring, coyotes inflict the greatest predation losses coincident with lambing and calving. Therefore, IPDM is intensified with all necessary methods including traps, snares, M-44s, and shooting being utilized.

Good visibility is required for effective and safe aerial shooting operations and relatively clear and stable weather conditions are necessary. Summer conditions limit the effectiveness of aerial shooting, as heat reduces coyote activity and vegetative ground cover greatly hampers visibility. High temperatures, which reduce air density, affect low-level flight safety and may further restrict aerial shooting activities. Other restrictions include higher elevations, dense vegetation cover, and rugged terrain.

WS-Montana responses to requests for preventative aerial shooting have occurred in a portion all of the counties in Montana accept three (Carter, Richland, and Powder River) who contract with private predator damage management businesses. Aerial shooting occurs only on lands where it is authorized and when under agreement, primarily on private lands. During late fall and winter (November through March), requests for IPDM assistance on lambing and calving grounds on private property and some BLM grazing allotments increase. Aerial shooting can also be conducted by other entities under permit from the MDOL to remove coyotes for livestock protection (Section 1.7).

The current WS-Montana program is or may be conducted on private, public, tribal, and other lands where a request has been made, the WS-Montana employee has determined that the problem is caused by a predator, and appropriate agreements for assistance have been finalized. All management actions comply with appropriate federal, state, territorial, tribal, and local laws (Section 2.4).

Any strategy involving reducing the number of predators in a particular area during a regulated hunting/trapping season is the responsibility of MFWP as authorized by state law.

- **Methods that May Be both Lethal and Non-Lethal**

Some methods may be part of either a lethal or non-lethal strategy, or a combination of both. For example, foothold and cage traps may be used to capture animals for relocation or for euthanasia upon capture, depending on the circumstances, species, policy and regulatory requirements, and management objective APHIS-WS policy discourages relocation of captured offending animals that have a risk of continuing the problem in their new location, may spread disease, or not fare well due to intraspecies competition (Section 2.4). The American Veterinary Medical Association, the National Association of State Public Health Veterinarians and the Council of State and Territorial Epidemiologists also oppose relocation of captured problem animals because of the risk of disease transmission among wild mammals. Therefore, many animals captured using non-lethal methods are often euthanized per state and APHIS-WS policy.

- **Minimization Measures**

See Section 2.4 for list of minimization measures, including APHIS-WS Directives USDA Wildlife Services (2018c), state law and regulation, ESA terms and conditions and measures pertinent to this alternative. Table 2.1 summarizes the proportion of WS-Montana annual intentional predator take by method (Section 3.5, Table E.1) and Table 2.2 summarizes the annual intentional predator take by land class. Most predators intentionally taken by WS-Montana during IPDM activities occur on private land, and most of those are coyotes.

Table 2.1. **WS-Montana Percent Intentional Lethal Take of Predators by Method, FY 2013 - FY 2017[1].**

Common Name	DRC-1339	Firearms	Aerial Shooting	M44	Snares	Traps	Gas Cartridges	Total
Badger	0	3%	0	0	77%	20%	0	100%
Black bear	0	37%	0	0	41%	22%	0	100%
Grizzly bear	0	0	75%	0	25%	0	0	100%
Bobcat	0	0	0	0	100%	0	0	100%
Feral cat	0	50%	0	0	0	50%	0	100%
Coyote	0	15%	64%	7%	11%	2%	1%	100%
Feral dog	0	0	0	0	0	0	0	-
Red fox	0	2%	6%	9%	41%	15%	27%	100%
Mountain lion	0	17%	0	0	22%	61%	0	100%
Raccoon	0	0	0	0	96%	4%	0	100%
Raven	95%	4%	0	0	0	1%	0	100%
Striped skunk	0	2%	0	0	26%	72%	0	100%
Gray wolf	0	13%	68%	0	3%	16%	0	100%
Feral swine	0	0	0	0	0	0	0	-

Take data from USDA-WS-APHIS Management Information System (2018)

Table 2.2. Percent Intentional Lethal Take of Predator Species by WS-Montana during IPDM Activities Occurring on Each Land Class, FY 2013 - FY 2017[1].

Species (Total WS-Montana 5-year Intentional Take)	BLM	County/ City	Forest Service	Private	State	Tribal	Other	Total[1]	% Total Predator Intentional Take by Species
Badger (39)	0	69%	0	31%	0	0	0	100%	**0.11%**
Black bear (49)	0	0	2%	98%	0	0	0	100%	**0.14%**
Grizzly bear (4)	0	0	0	100%	0	0	0	100%	**0.01%**
Bobcat (1)	0	0	0	100%	0	0	0	100%	**<0.01%**
Feral cat (2)	0	100%	0	0	0	0	0	100%	**0.01%**
Coyote (31,933)	4.5%	0	0.5%	93%	1%	1%	0	100 %	**94.1%**
Feral dog (0)	0	0	0	0	0	0	0	-	**0**
Red fox (898)	1%	7%	0	92%	0	0	0	100%	**2.65%**
Mountain lion (72)	0	0	0	94%	0	6%	0	100%	**0.21%**
Raccoon (23)	0	17%	0	83%	0	0	0	100%	**0.07%**
Raven (606)	0	3%	0	97%	0	0	0	100%	**1.79%**
Striped skunk (47)	0	57%	0	43%	0	0	0	100%	**0.14%**
Gray wolf (260)	3%	0	20%	64%	5%	8%	0	100%	**0.77%**
Feral swine (0)	0	0	0	0	0	0	0	-	**0**
% Total Predator Intentional Take by Land Class	**4.5%**	**0.4%**	**0.6%**	**92.6%**	**0.8%**	**1.1%**	**0**	**100%**	100%

Take data from USDA-WS-APHIS Management Information System (2018)

2.3.1.8 *What is Involved in Management of Wildlife Hazards to Aircraft and Air Passengers?*

Upon receiving a request for assistance for IPDM from an airport authority, WS-Montana can provide a variety of services, including assessing the situation, developing an operational plan, and assisting with implementing a plan. WS-Montana may identify and evaluate hazards to aircraft and flight operations due to problematic predators present and when requested prepares a Wildlife Hazard Assessment. Then, WS-Montana may assist the airport in developing a Hazard Management Plan to address those hazards and threats or be requested to assist airports in implementing an existing management plan. The Hazard Management Plan may be combined with recommendations for resolving all wildlife species, including birds, that are or at risk of causing hazards at the airport. However, while aviation hazards caused by predatory animals are included in this EA, avian hazards are outside the scope of this EA.

Direct operational activities consist of various harassment, live-capture, and lethal removal techniques aimed at removing mammalian predators causing hazards. WS-Montana personnel also provide ongoing technical advice to airport managers regarding methodologies to reduce the presence of wildlife in areas of operations within airports, including providing technical advice on various habitat management projects that could be implemented by airport personnel. In addition, WS-Montana promotes improved wildlife strike hazards recordkeeping, provides wildlife identification services (such as collecting evidence such as feathers or fur, which may be all that is remaining after a strike), and monitors animal numbers at participating airports to assist in developing an effective predator damage management program.

2.3.1.9 *What Other Entities Conduct PDM in the Absence of WS-Montana Action?*

Humans have removed predators for centuries in response to fear, actual threats or attacks, competition and livestock depredation. Unregulated removals have resulted in eradication or severe range reductions in some cases. Indirect impacts to predator species from human activities include habitat and ecosystem losses and fragmentation and climate change (Sacks et al. 1999b, Prugh et al. 2009).

Currently, WS-Montana provides direct assistance for the reduction of damage or threats from several species of predators (see Section 1.5.2.3 and Table 1.1). In the absence of WS-Montana conducting these scientifically-driven IPDM actions, and it is likely that other agencies, groups, or individuals would increase their take or predators in an effort to alleviate the damage (see Section 3.4). WS-Montana's IPDM activities do not exist in a vacuum, and it is logical to consider the likely unintended consequences of both our actions and our inactions, as directed by the CEQ.

According to CEQ regulations, the "human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment" (40 CFR §1508.14). Further, in their "Forty Most Asked Questions" Council on Environmental Quality (1981a) states:

> "Where a choice of "no action" by the agency would result in predictable actions by others, this consequence of the "no action" alternative should be included in the analysis (Question 3; https://www.energy.gov/sites/prod/files/2018/06/f53/G-CEQ-40Questions.pdf)."

Therefore, WS-Montana will analyze not only the effects of its actions, but also the potential impacts that would occur when another entity takes the same or similar action in the absence of the APHIS-WS action.

One example of such an impact occurred when Marin County, California chose to discontinue funding WS-California's PDM program in the county in favor of a county-run cost-share program providing ranchers with funding assistance for the implementation of non-lethal management methods and compensation for livestock lost to predation. In the absence of WS-California's PDM operational assistance, individual livestock producers and their agents routinely practiced snaring, calling and shooting, and denning in an effort to kill coyotes, most intensely in winter and spring. It was also noted that when incidences of "hot spots" occur with multiple losses on adjacent ranches, ranchers may collaborate on hunting parties in an effort to reduce coyotes (Larson 2006); Section 1.13.5).

State agencies have the legal authority to respond to and manage wildlife conflicts. As discussed in Section 1.7, MFWP and MDOL have legal wildlife damage management authority, and these agencies issue depredation permits and permits for aerial shooting, respectively. In addition, MFWP can set take limits for game and furbearer predators during hunting and trapping seasons to manage population levels to meet state objectives (Section 1.7). Local authorities, including municipal and county animal control, are primarily involved with complaints regarding feral/free-ranging dogs and cats.

Per Montana statutes (MCA §87-1-225, §81-7-505, and §81-29-103), landowners or their agents may take any animals (not otherwise restricted by federal or state law) causing damage, nuisance, or concerns with human health or safety. However, for most species a permit to remove the animal is needed. Unprotected species, including coyotes, raccoon, badgers, red fox, and skunks do not require a permit to remove them and reporting take is not required. Coyotes and red fox may be taken by aerial gunning on private land with a permit from MDOL and permission from the landowner.

Private and commercial property owners can also request assistance from companies that have a permit from the MDOL to provide aerial hunting services, or those private and commercial property owners may authorize another person(s) as their agent to remove damaging species as outlined in MCA §87-1-225, §81-7-102, §81-7-501, §81-7-505, and §81-29-103. Currently 36 pilots are certified to provide aerial hunting services, and 3 Montana counties contract with private companies for their PDM services.

Given that federal, State, commercial, and private entities receive authorization to conduct predator damage management from the MFWP and the MDOL, and that most methods for resolving predator damage are available to both WS-Montana and to non-federal entities (except for DRC-1339), it is clear that even under all the alternatives, including those in which WS-Montana is not involved with direct (lethal) IPDM, other entities will be conducting IPDM (Section 2.3.1.10, Table 2.3, and 3.4).

All non-lethal methods and most lethal methods are available to non-WS-Montana entities. Only WS-Montana has authority to use DRC-1339 in Montana per the FIFRA label. M-44s are available for use by MDA licensed pesticide applicators in Montana. M-44s are not commonly used by WS-Montana staff (average 448 coyotes per year); M-44s accounted for approximately 7% of total annual coyote take by WS-Montana FY 2013 through FY 2017 (MIS 2018). WS-Montana generally uses M-44s in situations where coyotes have proven difficult to remove using other methods. Given the restrictions on non-WS-Montana use, and the relatively low number of coyotes taken by M-44 by WS-Montana, non-WS-Montana entities are likely to substitute use of M-44s with more extensive use of traps, snares, and shooting.

Table 2.3. Annual Average Recorded and Estimated Predator Take (MFWP, MDOL, and USFWS), 2013-2017. [annual take is presented in Ch. 3]

Common Name	Non-Hunting/Trapping Take (MFWP and/or USFWS)[1]	Take Reported to MDOL (aerial)[2]	Hunting/ Trapping Take Reported to MFWP[3]	Known Illegal Take[4]
Coyote	-	507.8	17,533	-
Red fox	-	3.4	1,884	-
Raven	23	-	-	-
Gray wolf	-	-	227	6.6
Mountain lion	14.4	-	491	6.2
Striped skunk	-	-	1,380	-
Black bear	16	-	1,469	8
Badger	-	-	887	-
Raccoon	-	-	4,175	-
Grizzly bear	8.6	-	-	6.2
Feral dog[5]	-	-	-	-
Feral cat[5]	-	-	-	-
Bobcat	-	-	1,375	-
Feral swine	-	-	-	-

[1] Non-hunting trapping take indicates management removals by MFWP for black bear and mountain lion (B. Inman, personal communication, 8/20/2018), USFWS authorized management removals for grizzly bear (C. Costello, personal communication, 8/15/2018 and https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-science_center_objects=4#qt-science_center_objects), and USFWS MBTA permitted take for private entities for ravens (K. Gonzales, personal communication, 8/22/2018).

[2] Take reported in this column is non-WS aerial take permitted by MDOL (S. Boudreau, personal communication, 8/14/2018).

[3] Hunting or trapping take is either from MFWP furbearer reports (2013-2016 https://myfwp.mt.gov/fwpPub/harvestReports) or from direct communications with MFWP for black bears and mountain lions and 2017 furbearer report (B. Inman personal communications, 8/20/2018 and 4/12/2019).

[4] Illegal take is from direct communications with MFWP for grizzly bears in the Northern Continental Divide Ecosystem (C. Costello, personal communications 8/29/2018). Mortality data available for grizzly bears in the Greater Yellowstone Ecosystem (https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-science_center_objects=4#qt-science_center_objects) was not specific enough to accurately

identify illegal take because many of the mortalities of known cause were listed as under investigation without any further details. Illegal take for black bear and mountain lions is from MFWP staff (B. Inman, personal communication, 8/20/2018).
[5] Cats and dogs are managed by local authorities and take cannot be estimated.

2.3.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance.

WS-Montana would provide technical assistance, providing both non-lethal and lethal recommendations, advice, and information for others to implement, and would provide assistance to implement non-lethal IPDM activities. Under this alternative, WS-Montana personnel would not operationally use lethal methods to attempt to resolve wildlife damage, including when requested for protecting human/pet health or safety.

This is similar to Alternative 1 (Proposed Action/No Action) except that WS-Montana field personnel would not be available to directly provide any lethal operational assistance to any requester, even if contracted as an agent of MDOL. Requestors would be dependent on purchasing assistance from commercial companies, pilots with state aerial depredation permits, MFWP or their agents, or conduct the actions themselves as allowed by state law (Sections 1.7 and 2.3.1).

Non-lethal and lethal technical assistance would continue to be provided to cooperators and requesters as described in Alternative 1. Non-lethal technical assistance includes collecting information about the species involved, the nature and extent of the damage, and previous methods that the cooperator had used to alleviate the problem. WS-Montana would then provide the cooperator with information on appropriate non-lethal and lethal methods to alleviate the damage themselves. Types of technical and direct non-lethal assistance projects may include a visit to the affected property, written communication, telephone conversations, or presentations to groups such as homeowner associations or civic leagues.

In some cases, WS-Montana may provide supplies, materials, or cost-shares for non-lethal methods that are of limited availability for use by private entities, such as loaning propane cannons. Generally, WS-Montana could describe several non-lethal management strategies to the requester for short- and long-term solutions to managing damage, as well as recommend and provide training on lethal techniques. Those persons receiving technical assistance from WS-Montana could implement those recommended methods, could use other lethal and non-lethal methods not recommended by WS-Montana, could seek assistance from other entities, or take no further action. While WS-Montana could recommend both non-lethal and lethal methods, WS would only loan equipment or implement those non-lethal methods legally available for use by the requester and advise them of any permits needed.

Between FY 2013 and FY 2017, WS-Montana has conducted 13,122 technical assistance projects that involved wildlife damage to agricultural resources, property, natural resources, and threats to human safety. Of those technical assistance projects, 89% were instances where WS-field specialists recommend an IPDM strategy to manage damage caused by predators that included non-lethal tools.

Under this alternative, WS-Montana could recommend any of the lethal and non-lethal technical assistance methods discussed in Appendix A to assist cooperators using an integrated wildlife management approach. WS-Montana employees would provide technical information, demonstrations and training, and operational assistance on non-lethal management methods. These could include livestock guarding dogs, frightening devices, chemical repellents, harassment, fencing, exclusion, animal husbandry, modification of human behavior, habitat modification, and live traps. Capture followed by chemical immobilization and relocation could be implemented by WS-Montana where permitted under state law and APHIS-WS policy. WS-Montana may also recommend that property owners or managers allow predators to be harvested during the regulated hunting and/or trapping season for those species in an attempt to reduce the number of animals causing damage on their properties. Establishing hunting and trapping seasons and the allowed harvest during those seasons is the responsibility of the MFWP. This alternative places the immediate burden of operational damage management work and any environmental compliance responsibilities on the resource owner, other governmental agencies, and/or private businesses.

WS-Montana would have no responsibility for any lethal and non-lethal actions implemented by requesters upon advice and recommendations from agency personnel. Requesters are responsible for compliance with all applicable federal and state laws and regulations including the Endangered Species Act, and others.

2.3.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance Before Applying Lethal Assistance.

Under Alternative 3, WS-Montana would provide both non-lethal and lethal technical and operational assistance to requesting cooperators, similar to Alternative 1. However, reasonable non-lethal methods would have to be shown ineffective to resolve the damage or threat before WS-Montana could take lethal action, regardless of the results of the strategies determined to be effective based on use of the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b). WS-Montana would use non-lethal methods first in response to every request for assistance regardless of severity, intensity, and immediacy of the damage or threat or the results of application of the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b).

Depredation from previous years or seasons could not be used as a reason for applying proactive lethal management. Lethal operational assistance could not be taken until WS-Montana had confirmed and recorded that reasonable non-lethal actions had not resolved the problem, that the problem is ongoing, and that lethal methods would effectively address the depredation. The definition of “reasonable” is determined in the field by the WS-Montana employee in coordination with the cooperator, but it must include consideration of the specific circumstances (for example, building anti-predator fence around a large pasture is most likely not “reasonable”, but it would be reasonable around a smaller holding area), conditions (for example, weather, proximity to residences, access by the public), or exorbitant costs.

Non-lethal and lethal technical assistance, as well as non-lethal preventive damage management, would continue to be used as described in Alternative 1.

This alternative requires that:

- Livestock grazing permittees and operators, landowners, and resource managers - with the assistance of WS-Montana, if desired- show evidence of sustained and ongoing use of reasonable non-lethal or husbandry techniques aimed at preventing or reducing predation prior to receiving WS-Montana assistance with lethal IPDM methods;
- Employees of WS-Montana use or recommend appropriate and reasonable non-lethal techniques in response to a confirmed damage situation prior to using lethal methods; and
- Lethal techniques be used only when WS-Montana had recorded and confirmed that the use of reasonable non-lethal techniques had failed to keep livestock or other losses below an acceptable level, as determined by the cooperator.

Cooperators would still have the option of implementing lethal control measures on their own or through commercial companies. WS-Montana would continue to recommend lethal and non-lethal management when and where appropriate as technical assistance.

Per APHIS-WS Directives USDA Wildlife Services (2018c), preference is given to the use of non-lethal methods over lethal methods when appropriate and effective. It is not necessary that all possible non-lethal methods be used before lethal operations can be implemented; only that the requester have implemented and tested reasonable non-lethal methods under the circumstances.

See Section 2.4 for list of minimization measures, including APHIS-WS Directives USDA Wildlife Services (2018c), state law and regulation, ESA terms and conditions and measures pertinent to this alternative.

2.3.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species.

WS-Montana provides full IPDM technical assistance, including both lethal and non-lethal methods, and lethal operational assistance only when requested for protecting human/pet health or safety or federally-listed T&E species, or to eradicate invasive feral swine. All other operational assistance could only use non-lethal methods. For instances of human/pet health or safety, protection of federally-listed T&E species, or to eradicate invasive feral swine, all lethal and non-lethal IPDM methods described in Alternative 1 and Appendix A are available for recommendation and/or use. For all instances not including humans, pets, federally-listed T&E species, and feral swine, only the non-lethal operational methods and lethal and non-lethal technical assistance are available for use, as described in Alternative 1 and Appendix A.

See Section 2.4 for list of minimization measures, including APHIS-WS Directives and state laws and regulations pertinent to this alternative.

2.3.5 Alternative 5. No WS-Montana Involvement in IPDM Activities

WS-Montana would not be involved in any predator damage management efforts in Montana. IPDM would still be implemented by other legally-authorized entities, such as MFWP, USFWS, property owners, commercial IPDM companies, and MDOL-authorized pilots (Sections 1.7 and 2.3.1). Entities experiencing damage caused by predators could continue to resolve damage by employing all methods legally available, since the removal of predators to alleviate damage or threats would occur despite the lack of involvement by WS-Montana.

WS-Montana would not provide assistance with any aspect of managing damage caused by predators in Montana, including lethal and non-lethal technical or operational assistance and actions. Requesters would need to seek IPDM information on existing and new methods (including methods developed and tested by the APHIS-WS NWRC) from other sources such as MFWP, Montana State University Extension Service offices, or pest control companies. Currently, MFWP only provides direct wildlife damage management assistance in limited situations, but does provide technical assistance and issues depredation permits for such activities as appropriate and within available resources. Requests for IPDM information directed to WS-Montana would be redirected to these entities.

2.4 What Are the Protective Measures including Policies, Consultation Measures and State Laws that WS-Montana Implements to Avoid or Reduce Adverse Effects?

The measures listed in this section improve the safety, selectivity, and efficacy of predator damage management activities and reduce or eliminate unwanted environmental effects. WS-Montana IPDM activities have incorporated these measures into the current program, and these measures are also incorporated into any other described alternative in which some level of operational WS-Montana activities would occur (Alternatives 1, 2, 3, and 4), as relevant. For example, APHIS-WS policies involving lethal take included in its directives would not apply to alternatives in which WS-Montana would not take lethal action, although the agency could recommend such actions under technical assistance.

While the following measures are implemented by WS-Montana, not all procedures pertain to the prevention or minimization of environmental impacts, such as personnel safety procedures for firearms. However, the measures included in this section address issues considered in detail in Chapter 3.

The measures in this section are organized into four major parts:

- APHIS-WS policies included in formal directives, categorized by topic
- WS-Montana formal and informal consultations with the USFWS
- Additional measures
- Relevant State of Montana laws and regulations

2.4.1 APHIS-WS Policies in Formal Directives

Individual measures in italics are direct quotes from APHIS-WS policies and formal directives.

2.4.1.1 APHIS-WS Administrative Policies

WS Directive 2.101: Selecting Wildlife Damage Management Methods
WS Directive 2.201: WS Decision Model [Requests for Assistance]

WS Directive 2.210: Compliance with Federal, State, and Local Laws and Regulations

a.	*Technical and direct control (operational) assistance may involve the use of either lethal or non-lethal methods, or a combination of the two. Preference is given to non-lethal methods when practical and effective.* (WS Directive 2.101)
b.	*Wildlife damage management services are provided only in response to requests for assistance.* (WS Directive 2.201)
c	*All employees (Federal and non-Federal) are responsible for conducting official duties in compliance with all Federal laws, and also applicable State and local laws that do not directly and substantively conflict with and frustrate WS' Federal statutory authorities. In a situation requiring a variance from a State of local law or regulations that does not directly and substantively conflict with and frustrate WS Federal statutory authorities, either a State or local authority agrees to carry out the action in cooperation with WS or a written authorization or concurrence must be obtained from the appropriate State or local authority.* (WS Directive 2.210)

2.4.1.2 APHIS-WS Policies Regarding Capture Devices

WS Directive 2.450: Traps and Trapping Devices

a.	*All employees whose duties involve animal capture should participate in a WS approved trapper education course as recommended by Best Management Practices guidelines. State Directors may provide for continuing trapping education for appropriate employees at district, state, or regional meetings.*
b.	*Use of all traps, snares (cable device), and other animal capture devices by WS employees will comply with applicable federal, state, and local laws and regulations related to animal capture for managing wildlife damage.* [Also WS Directive 2.210 "Compliance with Federal, State, and Local Laws and Regulations." (Appendix B)]
c.	*All traps and trapping devices will be set in a manner which minimizes the chances of capturing non-target species. If possible, non-target animals that are captured will be released.*
d.	*If an animal that appears to be a licensed pet is captured, reasonable efforts will be made to notify the owner, seek veterinary care if necessary, or deliver the animal to appropriate local authorities.*
e.	*Animals targeted for lethal control in direct control (operational assistance) projects will be dispatched immediately, removed from capture devices, and properly disposed (also WS Directives 2.205 "Euthanizing Wildlife", 2.510 "Fur, Other Animal Parts and Edible Meat", and 2.515 "Disposal of Wildlife Carcasses")*
f.	*Captured animals intended for release, relocation, or captivity will be handled and transported appropriately to achieve project objectives* (also WS Directive 2.501 *"Translocation of Wildlife"*)
g.	*Foothold traps or snares are not to be set closer than 30 feet from any exposed animal carcass or part thereof, having meat or viscera attached, including remains of animals previously removed from traps or snares (cable device) that may attract raptors or other non-target animals. If an animal carcass could be dragged or moved by scavengers to within 30 feet of set foothold traps, snares (cable device), the carcass will be secured to restrict movement* (also WS Directive 2.455, *"Scents, Baits, and Attractants"*). *These restrictions do not apply to animal carcasses used to attract bear or mountain lion to approved capture devices.*
h.	*The use of foot-hold traps and spring activated leg snares (cable device) must incorporate pan-tension devices as appropriate to prevent or reduce the capture of non-target animals, unless such use would preclude capture of the intended target animals.*

i.	*Foothold traps with inside jaw spread greater than 5 ½ inches, when used in restraining sets, are limited to types with smooth, offset jaws that may or may not be laminated or to padded-type jaws. Foothold traps with teeth or spiked jaws are prohibited. WS Regional Director may authorize use of modified jaw protrusions on traps for the purpose of reducing injuries to target animals.*
j.	*If it is necessary to use foothold traps or snares (cable device) under fence lines, reasonable efforts to be taken to obtain approval from adjacent landowners where applicable; judgment should be used to avoid capture of livestock and other domestic animals.*
k.	*The use of break-away locks or stops is encouraged when livestock, deer, or other large animals may be exposed to snare (cable device) sets.*
l.	*Capture devices should be set to minimize visibility of captured animals.*
m.	*Foothold traps (long-spring or coil spring) will not be used to take bear.*

2.4.1.3 Use of Firearms

WS Directive 2.615: WS Firearm Use and Safety

a.	*All WS-Montana use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees will be trained and certified per WS Directive 2.615 "Firearms Use and Safety" and WS Directive 2.625 "Pyrotechnics, Rocket Net Charges and Incidental Explosive Materials" and its Attachment 1 for safe and secure storage and transportation of the materials.*
b.	*Shooting a firearm, projectile or pyrotechnic out of a vehicle is permitted as long as the firearm or device is not loaded (a cartridge in the chamber) until the muzzle is safely out of the window of the vehicle and a clear line of fire is established. The muzzle of the firearm or device may not be retrieved back into the vehicle until the device has no live round in the chamber.*
c.	*Whether a firearm is being stored in an office, vehicle, home, camp, or any other location, the maximum level of security available should be employed. Security devices may range from gun safes, vaults, locking gun racks, to cables through the receiver or frame opening locked to an immovable object. All firearm storage will be per this Directive.*
d.	*All WS personnel, regardless of employment status, and official volunteers who are required or requested to use firearms in the conduct of official duties must adhere to all basic rules of firearm safety, and will be provided firearm safety and handling training per the WS Firearms Safety Training Manual. Aerial crewmember training will consist of instruction from the WS Firearm Safety Training Manual as well as additional specialized instruction that may be contained in the WS Aviation Operations Manual, the WS Aviation Safety Program Manual, and the WS Aerial Operation Crew Member Training Manual.*

2.4.1.4 Use of Explosive Materials

WS Directive 2.625: Pyrotechnics, Rocket Net Charges, and Incidental Explosive Materials

a.	*WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."*
b.	*All storage and transportation of pyrotechnics, rocket net charges and incidental explosive materials will be conducted per the standards in Attachment 1 of* WS Directive 2.625.
a.	*All WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or*

	other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."
b.	*All storage and transportation of pyrotechnics, rocket net charges, and incidental explosive materials will be conducted per the standards in Attachment 1 of* WS Directive 2.625.
a.	*All WS use, storage, and transportation of explosives will be in compliance with applicable Federal, state, and local laws and regulations. Employees assigned to use pyrotechnic pistols or other launching devices will receive safety training in their use as required by WS Directive 2.615 "Firearms Use and Safety."*

2.4.1.5 Use Hazardous Materials and Pesticides

WS Directive 2.465: Accountability and Oversight of Hazardous Materials
WS Directive 2.401: Pesticide Use

a.	*During the fiscal year, at least one annual physical inventory will be conducted by the hazardous material user and one reviewing official (i.e., District Supervisor, Assistance District Supervisor, collateral duty safety officer) designated by the State Director. All hazardous materials discrepancies will be resolved by the pesticide user and/or the reviewing official at the time of the physical inventory, if possible. All discrepancies will be corrected in the MIS CMITS database within 30 days. Some of the subject matter that will be reviewed regarding hazardous materials is as follows: security, storage, warning signs, inventory, receipt and transfer of documentation, handling, disposal of pesticides, I&E [immobilization and euthanasia] drugs, pyrotechnics, etc.* (WS Directive 2.465)
b.	*WS activities will be in compliance with applicable Federal, State, Tribal, and local laws and regulations pertaining to pesticides, including application, certification, storage, transportation, shipment, disposal, and supervision, or when recommending the use of restricted-use pesticides. Restricted use pesticides used or recommended by WS personnel must be registered by the U.S. Environmental Protection Agency (EPA) and the appropriate State regulatory agency.* (WS Directive 2.401)
c.	*For field applications, where other decontamination equipment of sufficient quantity and type is not readily available, WS personnel must carry a decontamination kit containing at least one quart of water, coveralls, disposal towels, and soap. Incidents and/or accidents resulting from the use of pesticides must be immediately reported to the appropriate supervisor and the WS Safety and Health Council. The WS Safety and Health Council is responsible to investigate and/or coordinate the investigation of any incident or accident related to the use of pesticides. WS personnel are required to report to the State Director, any knowledge of adverse incidents involving APHIS registered products.* (WS Directive 2.401)
d.	*All storage, transportation, inspections, training, and emergency procedures will be conducted according to WS Directive 2.401 Attachment 1.* (WS Directive 2.401)

2.4.1.6 Use of M-44s

WS Directive 2.415 M-44: Use and Restrictions
Excerpts from Memorandum from the Deputy Administrator December 27, 2019

a.	*M-44 sodium cyanide capsules may only be used as directed in WS Directive 2.415, and conform to all applicable federal, state, and local laws and regulations, and any EPA regulations or requirements. (Use restriction #1, 2)*
b.	*Each applicator of the M-44 device shall be trained in: (1) safe handling of capsules and device, (2) proper use of the antidote kit, (3) proper placement of the device, and (4) necessary record keeping. (Use Restriction #3)*
c.	*M-44 devices and capsules will not be transferred to or entrusted to the care of any person not supervised by APHIS-WS. If more than one governmental agency is authorized to place M-44s,*

	agencies shall share information to avoid exceeding maximum numbers allowed. (Use Restriction #4, 11)
d.	*M-44s will only be used to control wild canids to protect livestock, federally designated T&E species, or to control vectors of a communicable disease. They will not be used solely to take animals for their fur. (Use Restriction #5, 6)*
e.	*The M-44 device shall only be used on or within seven miles of a ranch unit or allotment where losses due to predation by wild canids are occurring or where losses can be reasonably expected to occur based upon recurrent prior experience of predation on the ranch unit or allotment. Full documentation of livestock depredation, including evidence that such losses were caused by wild canids, will be required before application of the M-44s are undertaken. This use restriction is not applicable when wild canids are controlled to protect Federally designated threatened or endangered species or are vectors of a communicable disease. (Use Restriction #7)*
f.	*M-44 device shall not be used: (1) in areas within national forests or other Federal lands set aside for recreational use, (2) *within 600 feet of an occupied residence, (3) in prairie dog towns, or (4) in National or State Parks, National or State Monuments, federally designated wilderness areas, and wildlife refuge areas. The APHIS State Director or his/her designated representative who are considering authorizing or are responsible for ongoing use of M-44 capsules on public lands, must contact each applicable land management agency quarterly to determine whether any portions of the projected or current M-44 use areas are or are to be set aside for recreation use. Within 30 days of that contact, the APHIS State Director, or his/her designated representative, must provide the applicable land management agency with written documentation specifying the applicable land management agency's determinations of what projected or current M-44 use areas are to be set aside for recreational use. For purposes of this Use Restriction, areas set aside for recreational use include areas where and when there are scheduled recreation events, areas identified on maps with the word "recreation" in the title, areas where developed or known camping occurs, areas near designated or known* recr*eational trail heads and designated or known vehicle access sites. *WS must notify each residence within 0.5 miles of an M-44 device prior to placement. Notification can be in person, in person via telephone (not voicemail), by certified mail, or via a door hang tag. (Use Restriction #8)*
g.	*The M-44 device shall not be used in areas where Federally-listed threatened or endangered species might be adversely affected. Each applicator shall be issued a map, prepared by or in consultation with the U.S. Fish and Wildlife Service, which clearly indicates such areas. If maps covering the application site do not exist, then the M-44 applicator must, prior to application, consult with the FWS to determine whether the application site is in an area occupied by listed animal species. The M-44 device may be used in areas occupied by endangered, threatened, or experimental populations if use in such areas 1) has been addressed by FWS in special regulations related to Section 4(d) of the ESA, in requirements imposed through incidental take statements or incidental take permits, or in other applicable agreements with the FWS and b) the applicator's use of the M-44 is consistent with any conditions or limitations provided by FWS for such use. (Use Restriction #9)*
h.	*One person other than the individual applicator shall have knowledge of the exact placement of all M-44 devices in the field. (Use Restriction #10)*
i.	*The M-44 device shall not be placed:* • *Within 200 feet of any lake, stream, or other body of water, provided that natural depression areas which catch and hold rainfall for short periods of time shall not be considered "bodies of water;"* • *In areas where food crops are planted;*

	• *within *300 feet of any public road or pathway, or will be placed at a such a greater distance from any public road or pathway as may be necessary to remove it from sight of persons and domestic animals using any such public road or pathway;* • *The maximum density of M-44s placed in any 100 acre pastureland shall not exceed 10; and the density in any one square mile of open range shall not exceed 12; and* • *Within 30 feet of a livestock carcass used as a draw station. No more than four M-44 devices shall be placed per draw station and no more than five draw stations shall be operated per square mile. (Use Restriction #12, 13, 14, 15, 16)*
j.	*Supervisors of applicators shall check the records, warning signs, and M-44 devices of each applicator and least once a year to verify that all applicable laws, regulations, and restrictions are being strictly followed. (Use Restriction #17)*
k.	*Each M-44 device shall be inspected at least once every week, weather permitting access, to check for interference or unusual conditions, and shall be serviced as required. Damaged or non-functional devices shall be removed from the field, and, if after 30 days there is no sign that a target predator has visited the site. (Use Restriction #18)*
l.	*Damaged or nonfunctional M-44 devices shall be removed from the field. Devices will be removed from the area if, after 30 days, there is no sign that a target predator has visited the site. Used capsules shall be disposed of by deep burial or at a proper landfill site. (Use Restriction # 19, 20, 22)*
m.	*All persons authorized to possess and use sodium cyanide capsules and M-44 devices shall store such capsules and devices under lock and key. (Use Restriction #21)*
n.	*Bilingual warning signs in English and Spanish shall be used in all areas containing M-44 devices. All such signs shall be removed when M-44 devices are removed. Main entrances or commonly-used access points to areas in which M-44 devices are set shall be posted with warning signs to alert the public to the toxic nature of the cyanide and to the danger to pets. Signs shall be inspected weekly to ensure their continued presence and ensure that they are conspicuous and legible. *Two signs shall be placed within 15 feet of each individual M-44 device in the two most likely directions of approach warning persons not to handle the device. (Use Restriction #23)*
o.	*Each authorized or licensed applicator shall carry an antidote kit on his person when placing and/or inspecting M-44 devices. The kit shall contain at least six pearls of amyl nitrate and instructions on their use. Each authorized or licensed applicator shall also carry on his person instructions for obtaining medical assistance in the event of accidental exposure to sodium cyanide when placing and/or inspecting M-44 devices. (Use Restriction #24)*
p.	*In all areas where the use of the M-44 device is anticipated, local medical people shall be notified of the intended use. They shall be advised of the antidotal and first-aid measures required for treatment of cyanide poisoning. (Use restriction #25)*
q.	*Each applicator will keep detailed records dealing with the placement and results of each placement. (Use Restriction #26)*

** Indicates restrictions updated in accordance with Memorandum from the Deputy Administrator (December 27, 2019)*

2.4.1.7 Translocation of Wildlife

WS Directive 2.501: Translocation of Wildlife

a.	*Translocation of wildlife from one geographic area to another may be conducted by WS personnel as a wildlife damage management activity when: a. Such activities are in accordance with the policies of regulating state and/or Federal wildlife management agencies. b. Such*

	activities are in accordance with all applicable Federal, State, and local laws and regulations.
b.	*Primary factors influencing translocation include availability of suitable habitat, impact (competition, predation, etc.), on the animals(s) to be moved as well as other species, the likelihood of animal returning, public attitudes, and potential for creating a damage/conflict situation at the new location.*

2.4.1.8 Disposal of Carcasses

WS Directive 2.515: Disposal of Wildlife Carcasses
WS Directive 2.510: Fur, Other Animal Parts, and Edible Meat

a.	*All wildlife carcasses, whether in whole or part, will be disposed of consistent with Federal, State, county, and local regulations and WS Directive 2.210 "Compliance with Federal, State, and Local Laws and Regulations". Animals euthanized with drugs that may pose secondary hazards to scavengers must be disposed of according to Federal, State, county, and local regulations, drug label instructions, or lacking such guidelines, by incineration or at a landfill approved for such disposal.* (WS Directive 2.515)
b.	*Wildlife carcasses may be discarded on the property where they were killed or recovered, or deposited on another cooperator's property if approved by the respective property owner. Carcasses may be composted following Federal, state, and local laws. Wildlife carcasses or parts may be disposed of at approved public or private landfills where such facilities are approved for animal disposal. Carcasses shall not be deposited in roadside or commercial business dumpsters unless prior approval to do so has been obtained from the dumpster owner or lessee. Carcasses shall not be disposed of in household trash containers. Wildlife carcasses may be incinerated in approved facilities that comply with Federal, State, and local regulations. Open burning should be avoided due to potential fire hazards except when this method is required by regulations and can be conducted safely. All disposals will be made in a manner which demonstrates WS' recognition of public sensitivity to the viewing of wildlife carcasses.* (WS Directive 2.515)
c.	*Furs, animal parts, or edible meat may be donated, salvaged, sold, or transferred when authorized by the State Director, in compliance with existing cooperative agreements, Memoranda of Understanding, and all applicable Federal, State, and local laws and regulations.* (WS Directive 2.515)
d.	*Feathers, claws, or other animal parts (except eagle parts and parts from the Federal and State listed threatened or endangered species) may be donated or transferred to Native Americans for ceremonial or religious purposes, or to universities, museums, State wildlife agencies, or other reputable organizations for use in scientific or educational purposes. Donating, transferring or transporting protected species will be coordinated through the State Director and cleared with the State wildlife agency, and in cases involving Federally protected species, with the USFWS. WS employees or family members, close relatives or acquaintances may not benefit from any animal(s), in whole or in part, taken by WS employees while conducting official duties. This includes but is not limited to, edible meats, fur, or valuable animal parts. Animal parts commonly used for making scents, baits, lures, and attractants, are excluded.* (WS Directive 2.510)

2.4.1.9 Immobilization and Euthanasia

WS Directive 2.505: Lethal Control of Animals [Euthanasia]
WS Directive 2.430: Chemical Immobilization and Euthanizing Agents [I&E]

a.	*WS personnel will exhibit a high level of respect and professionalism when taking an animal's life, regardless of method. WS personnel will be familiar with the methods described in the current AVMA Guidelines for Euthanasia, and those methods will be used to euthanize captured or restrained animals, whenever practicable. In free-ranging wildlife, the AVMA recommends*

	methods "be as age-, species-, or taxonomic/class-specific as possible." WS personnel will use methods appropriate for the species and conditions. (WS Directive 2.505)
b.	*When euthanizing a captured or restrained animal, death of the animal must be confirmed; death should be confirmed in free-ranging wildlife when carcass recovery is possible. Confirmation can be achieved by the absence of a blinking response when the cornea is touched and by monitoring heart rate and respiration for a period of time long enough to confirm death.* (WS Directive 2.505)
c.	*All WS-Montana personnel requiring use of immobilization and euthanizing drugs must comply with WS Directive 2.430 "Controlled Chemical Immobilization and Euthanizing Agents", including full training and certification. WS personnel using I&E drugs must receive training approved by the WS I&E Committee prior to independent use of possession of I&E drugs (Attachment 1).* (WS Directive 2.430)
d.	*Only I&E drugs approved by the WS I&E Committee can be used by WS personnel, unless under emergency situations (Attachment 2).* [Note: Attachment 2 of WS Directive 2.430 lists the approved I&E drugs.] *In emergency situations, unapproved I&E drugs can be used on a one-time or limited basis by WS personnel when approved by an attending/consulting veterinarian and the State director or designee, provided that such use is in compliance with all applicable laws.* (WS Directive 2.430)

2.4.1.10 Wildlife Hazards to Aviation

WS Directive 2.305: Wildlife Hazards to Aviation

a.	*WS-Montana personnel working at airports with WS agreements will notify the appropriate civil or military airport authorities as soon as practicable when imminent wildlife hazards to aviation are observed.*
b.	*WS-Montana managers will ensure that WS employees working at aviation facilities are provided with appropriate training and certifications commensurate with the responsibilities of their positions.*

2.4.1.11 Training for Aerial Operations

WS Directive 2.620: Required Training for Aerial Operations

a.	*All WS' aerial operations and safety activities, including training and maintenance, will be conducted in strict compliance with the WS Aviation Operations and Safety Manual; the Federal Aviation Regulations (FAR), the Fish and Wildlife Act of 1956 (Airborne Hunting), any applicable State and local laws and regulations, individual WS State and WS National Wildlife Research Center program Aviation Safety Plans, Aviation Communication Plan, and Aviation Emergency Response Plans. All pilots, crewmembers, ground crews, and aircraft maintenance personnel will adhere to the WS Aviation Operations and Safety Manual and its amendments, Title 14 Code of Federal Regulations (CFR) and FAR Part 43, 61, 91, 119, 133, 135, and 137. No aircraft shall be used in WS activities (either through contract, agreement, or volunteer) that have not been approved through the office of the WS national Aviation Coordinator (NAC), except for military transport and commercial travel purposes.*

2.4.1.12 Personnel Safety

WS Directive 2.601: Safety [of WS personnel]
WS Directive 2.635: Zoonotic Diseases and Personal Protective Equipment

a.	*WS supervisors will promote a safe working attitude among employees. Supervisors will identify hazards, including wildlife-borne diseases, in advance of work assignments. Supervisors will also provide employees with adequate information, training, and personnel protective equipment to optimize employee safety. Refer to WS Directive 2.635 "Zoonotic Diseases and Personal*

	Protection Equipment" for guidelines on personnel safety from zoonotic disease. (WS Directive 2.601)
b.	*WS employees will adhere to safety requirements and use appropriate personal protective equipment provided for assigned work. Employees are required to immediately report unsafe working conditions to their supervisor and work cooperatively to minimize hazardous working conditions*. (WS Directive 2.601)
c.	*WS personnel are advised to alert their physician that they may be exposed to wildlife-borne diseases. Serious diseases including rabies, hantavirus, plague, Lyme disease, psittacosis, Clamydia psittaci, or histoplasmosis may be misdiagnosed unless the physician is aware of the possibility of exposure.* (WS Directive 2.601)
d.	*WS employees will be provided with a Physicians Alert Card (APHIS Form 260 or APHIS Form 260A) which identifies a number of the more significant zoonotic diseases personnel are likely to encounter. Personnel will use the Physician's Alert Card when conferring with their physician about any illnesses or suspicious symptoms. Physical injury events such as animal scratches or bites (including embedded ticks) should be reported to the supervisor as soon as possible and documented within 30 days on a U.S. Department of Labor Form CA-1…If an employee experiences signs or symptoms of a suspected work-related illness, zoonotic disease, or parasitic infection/infestation, the employee should notify their supervisor as soon as possible and seek medical attention for a diagnosis and confirmation from a physician that the condition is in fact work-related.* (WS Directive 2.635)
e.	*All WS personnel who handle or are exposed to wildlife, biological samples, or equipment used to handle or process animals or biological materials will be provided disease safety, biosecurity, and PPE training as prescribed in the WS Biological Risk Management Training Manual. Specific PPE requirements will vary among positions and the specific duties of personnel. All PPE supplies (e.g. gloves, safety glasses, DEET) will be routinely monitored and supplemented or replaced as necessary.* (WS Directive 2.635)

2.4.1.13 Livestock Guarding Dogs

WS Directive 2.440: Livestock Guarding Dogs

a.	*All WS field personnel will be knowledgeable in the use and application of livestock guarding dogs. WS field personnel will assist producers who may be interested in using livestock guarding dogs by providing information and/or referring them to a WS guarding dog specialist for further assistance. Livestock guarding dogs are generally owned and managed by the livestock producer and are recognized by WS as useful for reducing predation.*
b.	*WS specialists must be cautious when working near or around guarding dogs to minimize potential hazards from applied management methods.*

2.4.1.14 Use of Trained Dogs

WS Directive 2.445: Use of Trained Dogs in WS Activities

a.	*It is WS policy that trained dogs shall only be used by authorized personnel, including volunteers and contractors, to conduct specific WS functions. It is permissible for WS personnel to use employee-owned or government-owned trained dogs in accomplishing WS missions where it is safe and legal to do so. Government-owned and employee-owned trained dogs should accompany the WS employee/handler on official duty only when there is an operational need.*
b.	*Use of contract or volunteered dogs (e.g. dogs not directly owned by WS or its employees) will be approved on a case-by-case basis by the applicable State Director. In such instances, the contracted or volunteer dog-handler must sign a form acknowledging that they will abide by WS Directive 2.445. In such instances the dog-handler must follow WS' guidelines and a WS employee must accompany the contract/volunteer dog handler throughout the operation.*

c.	*Dogs will not be allowed to intentionally kill animals. When the objective is removal, animals will be euthanized as quickly as possible via mortal gunshot. Mortal gunshot is the only approved means of euthanasia.*
d.	*Functions performed by trained dogs: wildlife hazing away from property or other resources; target animal detection to determine if further action is warranted; animal retrieval; decoying target wildlife into shooting range; trailing target animals to facilitate live capture or lethal removal.*
e.	*WS personnel shall not allow trained dogs to have physical contact with or in any way attack, bite, or kill animals that are restrained in a trap or any other device. When trained dogs are used, handlers will be at the site of encounters between animals and dogs as soon as possible to minimize stress and reduce potential injury. If WS personnel are unable to prevent a trained dog from repeatedly making contact with a restrained animal, WS personnel must immediately intervene and discontinue use of that dog.*
f.	*WS personnel shall ensure a dog-in-training is muzzled and controlled on a leash when it is near a restrained animal. If the dog-in-training attacks or attempts to attack a restrained animal, WS personnel must immediately stop the interaction. WS personnel must discontinue use of dogs-in-training that repeatedly attempt to physically contact restrained animals.*
g.	*WS personnel shall ensure trained dogs used in wildlife damage management activities receive housing, food, water, medical care, and are properly licensed and vaccinated according to state and local laws. WS personnel shall ensure dogs are provided a safe transport box. The box shall provide enough shade and ventilation during warm months to keep dogs cool. During cool months, insulation and/or reduced ventilation shall be used to keep dogs comfortable.*
h.	*Dog handlers shall control or monitor their trained dogs at all times. A trained dog is considered under control when the dog responds to the command(s) of the dog handler by exhibiting the desired or intended behavior as directed. Dog handlers shall ensure trained dogs to not pose a threat to humans or domestic animals, or cause damage to property. Further, dog handlers (whether WS employees or contractors) shall employ as needed various methods and equipment to monitor and/or control dogs, including but not limited to: muzzles, protective vests and collars, electronic training collars, harnesses, leashes, whistles, voice commands, global positioning system (GPS), telemetry collars, identification collar/contract information.*

2.4.1.15 Feral, Free-Ranging, and Hybrid Dog Management

WS Directive 2.340: Feral, Free-Ranging, and Hybrid Dog Damage Management

a.	*Where WS personnel determine that a captured dog is a pet, WS-Montana personnel shall inform the land/resource owner as soon as is practicable.*
b.	*In urban areas where local animal control officers exist [Note: or the Montana State Patrol are available], WS personnel shall collaborate with them to determine if WS action is necessary to solve the property or human health and safety problem associated with feral, free-ranging, or hybrid dogs. If WS action is necessary and requested by the local authority, WS personnel must achieve/conduct the following: (1) Written approval of the WS Regional Director; (2) Notification to the WS Deputy Administrator; and (3) Written request from the State, local or tribal authority with jurisdiction over feral, free-ranging, or hybrid dogs, if such local authorities with jurisdiction exist. WS personnel shall ensure that written requests for assistance include: (1) a statement of the problem; (2) the location and time frame for WS activities; and (3) sufficient details regarding the scope of the assistance requested.*

2.4.1.16 Tribal Government-to-Government Consultations

APHIS Directive 1040.3: Tribal Government-to-Government Consultations

a.	T*his Directive implements Executive Order (EO) 13175 [“Consultation and Coordination with*

	Indian Tribal Governments."] regarding consultation, collaboration, and coordination with Tribes. APHIS will respect the rights of sovereign tribal governments and provide an opportunity for Tribes to participate in policy and program development. Each Tribe will be provided an opportunity for timely and meaningful government-to-government consultation regarding policy actions that may have tribal implications. This Directive does not preclude APHIS from consulting with a Tribe when the Tribe and the agency agree that consultation may be desirable, even if consultation is not specifically required. To enhance the evolution of working relationships and mutual partnerships between APHIS and Native American governments, the Agency will be flexible. APHIS should accept all requests for consultation; the emphasis must be on accepting opportunities rather than declining. Consultation does not require APHIS to do everything a tribal representative requests, but rather requires the agency to take the Tribes' views, information, rights, and interests into serious deliberative consideration. Consultation should be part of an effort to cooperate and collaborate in good faith with tribal partners.

2.4.1.17 Federally Threatened and Endangered Species

WS Directive 2.310: Endangered and Threatened Species

Please see previous sections of Part A for relevant APHIS-WS Directives related to capture, use of chemicals, carcass disposal, and firearm use and safety that could also minimize the risk of adversely affecting Federally listed threatened and endangered species.

a.	*WS will conduct its activities to minimize impact on any federally listed endangered or threatened species or adversely modifying listed critical habitat.*
b.	*WS State Directors will assure that all of their WS employees (Federal and non-Federal) are familiar with the requirements of Section 7 of the Endangered Species Act, as amended. WS employees will also be familiar with Section 7 biological opinions on listed species potentially impacted by their wildlife damage management activities.*
c.	*WS State Directors will initiate consultation with the U.S. Fish and Wildlife Service (FWS) if new damage management programs, new methods, or newly listed species result in the potential for adverse impacts.*
d.	*During routine work activities, incidents involving impacts on listed species will be reported by WS field personnel within 24 hours to the appropriate WS supervisor.*
e.	*Unless otherwise authorized, the location of dead or seriously injured listed species will be immediately reported to the appropriate FWS Law Enforcement Office and State wildlife representative.*
f.	*When endangered species are responsible for causing damage, the WS State Director will work with the FWS to determine if acceptable solutions for controlling damage can be agreed upon and implemented.*
g.	*When a managing agency (Federal, state, tribal) requests WS assistance in protecting listed species or controlling damages caused by listed species, the requesting agency will bear responsibility for funding the work. The WS State Director will coordinate with appropriate Federal, state, and local agencies to arrange funding and determine acceptable control procedures.*

2.4.2 Formal and Informal Consultations with the USFWS for Montana

WS-Montana has completed informal and formal consultation with the USFWS per Section 7 of the Endangered Species Act for effects of all WS-Montana activities on federally-listed threatened and endangered species. The effects analyses and findings pertinent to this EA are based on consultations completed on July 24, 2009 (Biological

Opinion on WS-Montana Canada lynx) and June 8, 2012 (Biological Opinion on WS-Montana effects on grizzly bear) and are included in Sections 3.6. WS-Montana determined that PDM activities will have No Effect on all other listed species (whooping crane, piping plover, interior least tern, yellow-billed cuckoo, red knot, black-footed ferret, northern long-eared bat, pallid sturgeon, white sturgeon, bull trout, water howellia, Spalding's catchfly, Ute ladies' tresses, western glacier stonefly, and meltwater lednian stonefly; dated April 27, 2015 and February 21, 2020). WS-Montana continues to consult with the USFWS as needed to maintain compliance with the ESA for WS-Montana activities. The following list of measures from the informal and formal ESA consultation documentation addresses only those methods appropriate for terrestrial IPDM activities for target species within the scope of this EA.

2.4.2.1 Protective Conditions from the 2009 Biological Opinion (BO) on Canada Lynx, the 2012 BO on Grizzly Bears, and the 2020 Voluntary Minimization Measures for Wolverine Developed with MFWP

a.	Technical assistance and education is stressed in each control program so that property and resource managers can learn ways to avoid attracting predatory animals, and so that the public might be more willing to cooperate with recovery efforts.
b.	When working in an area that has Federally-listed threatened or endangered species or has the potential for these species to be exposed to PDM methods, WS-Montana personnel will be trained to recognize signs of the presence of these species and integrate protective measures to minimize or avoid risk of adverse effects.
c.	APHIS will not proceed with any action that the USFWS has determined could jeopardize the continued existence of any federally-listed threatened or endangered species, or that would adversely modify or destroy designated critical habitat.
d.	Per the WS Directive 2.310, incidents involving impacts on listed species will be reported within 24 hours to the appropriate WS-Montana supervisor, and the location of dead or seriously injured listed species will be immediately reported to the appropriate USFWS Law Enforcement Office and MFWP wildlife representative.
e.	**Within occupied grizzly bear habitat**: • Neck snares (with the exception of those with breakaway locks set for coyotes) would only be used by WS-Montana during the grizzly bear denning period (December 1 to March 1) and the likelihood of capturing a grizzly bear in a neck snare is extremely low. • WS will assist the USFWS and MFWP with grizzly bear recovery by maintaining interagency coordination and communication, reporting grizzly bear sightings, assisting with grizzly bear damage management, and assisting with research projects related to grizzly bear conservation and recovery. • WS personnel are trained in the identification of grizzly bears (particularly in distinguishing between black bears and grizzly bears) and grizzly bear sign: training will be conducted by WS in collaboration with the USFWS or MFWP and by attending annual bear handling workshops organized by these agencies. • WS personnel will carefully consider the possibility of the presence of grizzly bears before conducting any predator damage management activities within or adjacent to occupied grizzly bear habitat. If there are foreseeable conflicts with grizzly bears, WS will adjust operational plans to minimize the chances of adversely affecting grizzly bears.

	• If grizzly bear sign occurs in an area where WS plans to work, wolf traps would be set away from livestock carcasses to reduce the chance of capturing grizzly bears scavenging the kill; travel routes of grizzly bears in the area would be studied and WS would set wolf traps away from known grizzly travel routes where possible; if grizzly bears are in an area, WS would utilize scents at trap sites that are less attractive to grizzly bears such as wolf urine/scat; and where possible, wolf traps would be anchored to solid anchors such as trees, or to drags of at least 200 pounds.
f.	**Within occupied Canada lynx habitat**: • WS will restrict activities in areas of known, occupied lynx habitat. • WS will hold staff training on identifying lynx and lynx sign. • Only olfactory attractants in coyote sets would be used within known occupied Canada lynx habitat. Attractants with fish oil, anise oil, fresh meat baits or visual attractants likely to attract felids will not be used in occupied lynx habitat. • Pan-tension devices would be used on foot-hold traps and foot snares placed in occupied lynx habitat, reducing the likelihood of capturing animals weighing 35 pounds or less.
g.	**Within occupied wolverine habitat** above 7,000 feet: • In areas of Montana on federally managed public lands where wolverines may occur, foothold traps set by WS-Montana for capturing wolves, coyotes, and mountain lions will have offset laminated or offset malleable jaws. All foothold traps will be checked at least every 48 hours during the legal harvest wolf trapping season and daily during the period the legal harvest wolf trapping season is closed. Foothold traps set for wolves will have pan tension set at 8 pounds or more. • In areas of Montana on federally managed public lands where wolverines may occur, foot snares set for black bears, grizzly bears, or mountain lions will be checked daily. • In areas of Montana on federally managed public lands where wolverines may occur, foothold traps set by WS-Montana for capturing wolves and coyotes will be placed away from animal carcasses and not use musky or castor-based olfactory lures, unless the use of these lures are absolutely necessary. Additionally, a detailed site assessment will be performed by WS personnel to ensure no fresh wolverine sign is present. If sign indicates wolverines are actively using the project area, foothold traps will not be used. • In areas of Montana on federally managed public lands where wolverines may occur, neck snares set for capturing black bears, wolves, and mountain lions will be set so the bottom of the snare loop is at least 18 inches above the ground. Neck snares will not be used within occupied wolf range unless wolves are the target species. Neck snares will not be used in occupied grizzly bear range except Dec 1 through Feb 28. Neck snares will be placed away from animal carcasses, will not use musky or castor-based lures and WS-Montana will perform a detailed site assessment to ensure no fresh wolverine sign is present.

2.4.3 Additional Measures

2.4.3.1 Protection of Human/Pet Health and Safety

a.	Most PDM activities are conducted away from areas of high human activity except when directly applied on private landowner property to address a specific damage problem. If the risk of people being present exists, then activities are conducted during

	periods when human activity is low, such as at night or in the early morning when possible.
b.	On the rare occasions when WS-Montana is requested to immobilize bears for, or with, MFWP during or immediately before licensed black bear harvest season such that drug withdrawal may not be complete before harvest could occur, WS would mark the animal with ear tags labeled "*do not eat*" prior to release.
c.	In most cases, live traps, culvert traps, and snares set for bears are placed so that captured animals are not readily visible from trails or roads. However, culvert traps are also sometimes used in and near campgrounds, developments, dumpsters, and other areas which attract bears and which people frequent. In all cases, trap warning signs are placed on each end of the trap.
d.	Public safety zones are delineated and defined on Annual Work Plan maps by BLM and USFS, and changed or updated as necessary. Public safety zones are one-quarter mile (or other appropriate distance) surrounding residences, county, state or federal roadways, or developed recreation sites. PDM conducted on federal lands within identified public safety zones will generally be limited to activity aimed at the protection of human health and safety. However, a land management agency or cooperator could request PDM activities in the public safety zone for an identified need. Depending of the situation and applicable laws and regulations, WS-Montana could provide them service. However, the land management agencies would be notified of PDM activities that involve methods such as firearms, M-44s, dogs, and traps before these methods would be used in a public safety zone, unless specified otherwise in the AWP and as appropriate.

2.4.3.2 Operating on Public Lands, Including in Wilderness Areas, Wilderness Study Areas (WSAs), and other Special Management Areas on Federal Lands

a.	All WS-Montana IPDM actions conducted on BLM or U.S. Forest Service lands are conducted per interagency MOUs with associated annual work plans (see Section 1.9.2).
b.	IPDM conducted within BLM and USFS Wilderness Areas and Wilderness Study Areas is closely coordinated with the land management agency and performed in accordance with the respective BLM or USFS MOU and the Wilderness Act (16 U.S.C. 1131-1136).
c.	Outside of Wilderness Areas and Wilderness Study Areas, any unanticipated work not included in the Annual Work Plan will be coordinated with the authorizing federal officer.

2.4.3.3 Miscellaneous Measures

a.	WS-Montana will use the Bald Eagle Management Guidelines from USFWS (U.S. Fish and Wildlife Service 2007) and MFWP (Montana Bald Eagle Working Group 2010) to determine appropriate measures for avoiding non-purposeful take of eagles.
b.	**Use of Non-lead Ammunition.** WS-Montana will use non-lead ammunition when required by land management policies and as required by Federal, state, and tribal laws and when and where required by ESA Section 7 consultations.
c.	**Use of Existing Access.** Vehicle use is limited to existing roads and trails unless authorized by the land management agency or landowner for specific actions.

d	**Code of Ethics:** The APHIS-WS Code of Ethics requires that all WS employees maintain high personal and professional standards in support of the WS mission to provide Federal leadership in wildlife damage management solutions that are safe, effective, selective, economically feasible, and environmentally responsible. (WS Directive 1.301).

2.4.4 Relevant State Laws and Regulations

The measures listed in this section improve the safety, selectivity, and efficacy of predator damage management activities and reduce or eliminate unwanted environmental effects. State laws and regulations related to IPDM that do not improve IPDM or reduce environmental effects are not listed here but can be found in chapter 1. Measures included in this section from relevant state laws and regulations are paraphrased. This is not intended to be a complete and comprehensive list; please see the legal wording of state laws and regulations for more information.

2.4.4.1 Categories of Wildlife and Legal Take and Report of Take

MCA §87-1-201 MFWP Powers and Duties
MFWP shall supervise all the wildlife, fish, game, game and nongame birds, waterfowl, and the game and furbearing animals of the state; manage wildlife, fish, game, and nongame animals in a manner that prevents the need for listing under §87-5-107 or under the federal Endangered Species Act; manage listed species, sensitive species, or a species that is a potential candidate for listing in a manner that assists in the maintenance or recover of those species. In maintaining or recovering a listed species, a sensitive species, or a species that is a potential candidate for listing, MFWP shall seek, to the fullest extent possible, to balance maintenance or recovery of those species with the social and economic impacts of species maintenance or recovery.

MCA §87-2-101 Definitions
For the purposes of §87-1-201, predatory animals are defined as coyote, weasel, skunk, and civet cat.

MCA §81-7-102 MDOL to supervise destruction of predatory animals – Cooperation with other Agencies
MDOL shall conduct the destruction and control of predatory animals capable of killing, destroying, maiming, or injuring domestic livestock or poultry and adopt rules applicable to predatory animal control that are necessary and proper for the systematic destruction of the predatory animals by hunting, trapping, and poisoning operations and payments of bounties.

The department shall cooperate with authorized representatives of the federal government, MFWP, boards of county commissioners, voluntary associations of stockgrowers, sheepgrowers, ranchers, farmers, hunters, and anglers, and corporations and individuals in the systematic destruction of predatory animals by hunting, trapping, and poisoning operations.

MCA §81-7-101 Definition
For the purposes of §81-7-102, predatory animals are coyotes, red fox, and any other individual animal causing depredations upon livestock as also managed by MDOL.

MCA §87-6-106 Lawful taking to protect livestock or person
A person may kill or attempt to kill wildlife if the wildlife is attacking, killing, or threatening to kill a person or livestock. However, for purposes of protecting livestock, a person may not kill or attempt to kill a grizzly bear unless the grizzly bear is in the act of attacking or killing livestock. A person may kill or attempt to kill a wolf or mountain lion that is in the act of attacking or killing a domestic dog. A person who, under this section, take wildlife protected by this title shall notify MFWP within 72 hours and shall surrender or arrange to surrender the wildlife to MFWP. [While this state law will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (see below and 40 CFR 31734, July 28, 1975) supersede this state law.]

MCA §81-7-401 Killing of dogs harassing, destroying, or injuring stock
A dog that harasses (i.e. worries, chases, or runs after livestock), kills, wounds, or injures livestock, including ostriches, rheas, and emus, while off the premises owned or under control of its owner and on property owned, leased, or controlled by the livestock owner may be killed immediately by the owner of the livestock or an agent or employee of the owner or may be killed by the owner of the dog, when reasonably notified after due process, within 24 hours of notification.

MCA §81-29-101 Definitions
Feral swine means hog, boar, or pig that appears to be untamed, undomesticated, or in a wild state or appears to be contained for commercial hunting or trapping.

MCA §81-29-102 Control of feral swine
A person, a state agency, or a federal agency authorized by the state or the federal government is allowed to control or eradicate feral swine.

MCA §81-29-103 Presence of feral swine – notification – immediate threat
A person who believes feral swine are present on private or public property shall notify the board and, if authorized, assist in the control or eradication of the feral swine. A person or the person's agent who encounters feral swine on property owned or leased by that person may immediately eradicate the feral swine when it will expand its range without immediate eradication.

40 CFR 31734
Grizzly bears in the 48 conterminous States may not be taken except in defense of human life, or to remove demonstrable but "non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises...In addition, takings to remove demonstrable but non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises, can be performed only by Federal or State employees, and only after reasonable efforts to live-capture and release unharmed in a remote area the bear involved have failed.

2.4.4.2 Use of Pursuit Dogs and Traps, Snares, and Other Capture Devices

MCA §87-3-127 Taking of Stock Killing Animals
Livestock owners, their agents, or employees of the department or a federal agency may use dogs in pursuit of stock-killing black bears, stock-killing mountain lions, and stock-killing bobcats. Other means of taking stock-killing black bears, stock-killing mountain

lions, and stock-killing bobcats may be used, except the deadfall. Traps used in capturing bears must be inspected twice each day with the inspections 12 hours apart.

MCA §81-7-102 MDOL to supervise destruction of predatory animals – Cooperation with other Agencies
MDOL shall conduct the destruction and control of predatory animals capable of killing, destroying, maiming, or injuring domestic livestock or poultry and adopt rules applicable to predatory animal control that are necessary and proper for the systematic destruction of the predatory animals by hunting, trapping, and poisoning operations and payments of bounties.

The department shall cooperate with authorized representatives of the federal government, MFWP, boards of county commissioners, voluntary associations of stockgrowers, sheepgrowers, ranchers, farmers, hunters, and anglers, and corporations and individuals in the systematic destruction of predatory animals by hunting, trapping, and poisoning operations.

2.4.4.3 Protecting Human Safety

MCA §87-1-217 Policy for Management of Large Predators
In managing large predators (bears, mountain lions, and wolves), the primary goals of the department (MFWP), in order of listed priority, are to: 1) protect humans, livestock, and pets; 2) preserve and enhance the safety of the public during outdoor recreational and livelihood activities; and 3) preserve citizens' opportunities to hunt large game species.

MCA §87-6-106 Lawful taking to protect livestock or person
A person may kill or attempt to kill wildlife if the wildlife is attacking, killing, or threatening to kill a person or livestock. [However, for purposes of protecting livestock, a person may not kill or attempt to kill a grizzly bear unless the grizzly bear is in the act of attacking or killing livestock -This portion is currently superseded by federal statutes under ESA.] A person may kill or attempt to kill a wolf or mountain lion that is in the act of attacking or killing a domestic dog.

MCA §81-29-103 Presence of feral swine – notification – immediate threat
A person or the person's agent who encounters feral swine on property owned or leased by that person may immediately eradicate the feral swine when it poses an immediate threat of harm to a person.

2.4.4.4 Aerial Take

MCA §81-7-501 Aerial hunting
Except as provided in 81-7-505, a person, except for an employee of the state or the federal government who is acting within the scope of the person's employment, may not engage in the aerial hunting of predatory animals, including coyotes, red fox, and any other individual animal causing depredations upon livestock, without first obtaining a permit from MDOL.

MCA §81-7-505 Resident landowners authorized to aerially hunt over their own lands without a permit
Any landowner having residence and domicile in Montana may engage in the aerial hunting of predatory animals, including coyotes, red fox, and any other individual animal

causing depredations upon livestock, over that person's own land without a permit, provided the landowner annually notifies MDOL in writing that the landowner will be engaged in aerial hunting and gives an adequate description of the location of the land over which the landowner will aerially hunt.

ARM 32.22.104 A System for issuance of aerial hunting permits – Restrictions upon use of permit
A permittee may engage in aerial hunting only over areas authorized by MDOL where livestock depredation has occurred or is likely to occur and the landowner, administrator, lessee, or their agent has provided a signed authorization. Only coyotes and/or foxes may be hunted as set forth in the permit. Hunting or harassment of any other animal will result in revocation of the permit. Aerial hunting of coyotes and/or foxes may occur only for the protection of livestock, domestic animals, or human life. A permit may be modified to allow the aerial hunting of other predatory animal snot protected by federal law only under extraordinary circumstances.

2.4.4.5 Carcass Disposal and Report of Take

MCA §87-6-106 Lawful taking to protect livestock or person
A person may kill or attempt to kill wildlife if the wildlife is attacking, killing, or threatening to kill a person or livestock. However, for purposes of protecting livestock, a person may not kill or attempt to kill a grizzly bear unless the grizzly bear is in the act of attacking or killing livestock. A person may kill or attempt to kill a wolf or mountain lion that is in the act of attacking or killing a domestic dog. A person who, under this section, take wildlife protected by this title shall notify MFWP within 72 hours and shall surrender or arrange to surrender the wildlife to MFWP. [While this state law will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (See Section 2.4.1.22 and 40 CFR 31734, July 28, 1975) supersede this state law.]

MCA §81-29-103 Presence of feral swine – notification – immediate threat
A person or the person's agent who encounters feral swine on property owned or leased by that person may immediately eradicate the feral swine when it poses an immediate threat of harm to a person or property or will expand its range without immediate eradication. MDOL shall be notified as soon as is practicable.

2.5 What PDM Alternatives Are Not Considered in Detail?

Commenters responding to previous APHIS-WS predator damage management EAs have requested that APHIS-WS consider the following alternatives.

The CEQ regulations at 40 CFR §1508.14 state that agencies "shall rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."

By definition, a "reasonable" alternative must be one that meets the underlying need for action or goal:

- "proposal exists at that stage in the development of an action when an agency…has a goal and is actively preparing to make a decision on one or more alternative means of accomplishing that goal…" (40 CFR §1508.23).
- "The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." (40 CFR §1502.13)

Guidance in the CEQs "40 Most Asked Questions" (Council on Environmental Quality 1981a) states that reasonable alternatives must emphasize what the agency determines "is 'reasonable' rather than on whether the proponent or applicant likes…a particular alternative. Reasonable alternatives include those that are practical or feasible from the technical or economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant."

Consistent with NEPA regulations and CEQ guidance, WS-Montana reviewed alternatives and ideas proposed in comments to APHIS-WS IPDM EAs, and, in this section, identified and briefly described those that are determined by the agency as not reasonable per the CEQ criteria. The alternatives not considered in detail and the agency's rationale for not considering them are listed below.

2.5.1 Use of Only Technical Assistance by WS-Montana

WS-Montana would only respond to requests for assistance through providing recommendations involving lethal and/or non-lethal methods; WS-Montana would not conduct any operational assistance. Since this does not allow for any non-lethal operational assistance, this alternative is not considered in detail.

2.5.2 Use of Only Lethal Methods by WS-Montana

Under this alternative, WS-Montana would only provide technical and operational assistance using lethal predator damage management techniques. Prohibiting WS-Montana from using or providing technical assistance on effective and practical non-lethal PDM alternatives is not effective, not ethically acceptable to wildlife professionals, and is contrary to agency policy and directives (WS Directive 2.101), in which APHIS-WS gives preference to the use of non-lethal methods before lethal methods when practical and effective.

In some situations, non-lethal methods can supplement, reduce, or eliminate the need for lethal control, and may provide a more effective short-term or long-term solution to PDM problems than lethal methods. For example, the use of guard dogs may be effective at reducing predation rates of livestock, or installing proper fencing when practical can protect resources and exclude some predators from areas. In other circumstances, lethal methods best and most effectively resolve the damage in a timely manner. Also, at times lethal methods may not be available for use due to safety concerns or local ordinances prohibiting the use of some lethal methods.

The option to consider both lethal and non-lethal methods as part of the APHIS-WS Decision Model (Section 2.3.1.2) (Slate et al. 1992, USDA Wildlife Services 2014b) allows WS-Montana to use the most effective and practical methods available, while accounting for the many legal, logistical, biological, ethical, and environmental variables in each unique damage situation. Finally, most members of the public that comment on

APHIS-WS NEPA documents feel strongly that there be more emphasis on using non-lethal methods to resolve damages, which is already APHIS-WS policy (WS Directive 2.101).

For these reasons, this alternative is not considered in detail.

2.5.3 Use of Only Non-lethal PDM

WS-Montana would provide only non-lethal technical assistance and non-lethal operational assistance. WS-Montana would not implement nor advise others on the use of lethal methods.

Non-lethal technical assistance is included in Alternative 2 and considered in detail in this EA (Section 2.3.2), as well as in Alternatives 3 and 4 to a lesser degree. If the requester has taken all reasonable non-lethal actions and the problem still persists, it is not logical that the WS-Montana specialist would not also provide professional advice regarding effective lethal methods that are legal for the requester to use in Montana. Therefore, considering this alternative in detail would be redundant and would not be reasonable, logical, or professional.

Therefore, this alternative will not be considered in detail.

2.5.4 WS-Montana Verifies that All Possible Non-lethal Methods are Exhausted Before Implementing Lethal Operations

This alternative is similar to Alternative 3. However, in Alternative 3, only reasonable non-lethal methods applicable to the circumstances must be used and shown not to be effective in all cases. This alternative has been requested by various commenters, and requires that all non-lethal methods be used before any lethal operations can be implemented, including non-lethal methods that are not appropriate for the circumstances. This would result in the loss of substantial time, resources, and money for both the requester and WS-Montana in implementing and monitoring all these non-lethal methods. This would potentially result in large financial losses for the requester due to livestock lost from inefficiencies in the IPDM process and/or a high risk of human/pet health or safety risks, and /or major losses to ESA-listed species. Alternatives 3 and 4 considered in detail (Sections 2.3.3 and 2.3.4) provide reasonable and viable approaches for addressing the needs of requesters and concerns of commenters without incurring unreasonable and unacceptable risks and losses.

Therefore, this alternative will not be considered in detail.

2.5.5 Use a Bounty System for Reducing Animals Causing Damage

Bounty systems involve payment of funds (bounties) for killing animals considered "undesirable," and are usually proposed as a means of reducing or eliminating any species that causes damage to human-valued assets, especially predators. In addition, the circumstances surrounding the removal of animals using bounties are typically arbitrary and unregulated because it is difficult or impossible to ensure animals claimed for bounty are not taken from outside the area where damage is occurring.

APHIS-WS has no authority to establish a bounty system for population control, suppression, or extirpation. The setting of bounties occurs at the state level. Many states have either outlawed bounties, repealed bounty laws, or have no statutory involvement in bounties.

A recent example of a state bounty on predators (in this case coyotes), was Utah (https://wildlife.utah.gov/hunting-in-utah/hunting-information/762; viewed 12/9/2016). This bounty system ultimately did not increase participation in coyote hunting, added little to local economies compared with other coyote harvest strategies, cost harvesters additional money to participate, and was considered ineffective at reducing livestock and wildlife depredation (Bartel and Bronson 2003).

Bounties can become costly, do not effectively provide relief, and may encourage fraudulent claims. Therefore, this alternative will not be considered in detail.

2.5.6 Provide Compensation for Losses

This option is discussed in Section 1.13.6.2. Compensation for wildlife damage caused by wolves and grizzly bears, may be paid from the MLLB. However, damage caused by black bear and cougar cannot be paid from the MLLB, but may be paid by other available moneys as authorized by state law. APHIS-WS has no legal authority or jurisdiction to provide for financial compensation for losses. None of the predators included in this EA are covered by compensation allowances under the Agricultural Improvement Act of 2018 (aka the 2018 Farm Bill) through the Livestock Indemnity Program because compensation is provided by the state through the MLLB (Section 1.13.7.2). Difficulties with compensation programs are discussed in Bulte and Rondeau (2005) in Section 1.13.7.2. This issue is better addressed through the political process at the county or state level.

Therefore, this alternative will not be considered in detail.

2.5.7 Livestock Producers Should Exceed a Threshold of Loss Before PDM Actions are Taken

As explained in Section 1.12.2, two independent government audits, one conducted at the request of Congress, the other conducted by USDA and based on complaints from the public and animal welfare groups, found that, despite cooperator implementation of non-lethal actions such as fencing and herding, a need exists for APHIS-WS' program of direct and sometimes lethal predator damage management activities. The appropriate level or threshold of tolerance before using non-lethal and lethal methods differs among cooperators, their economic circumstances, and the extent, type, duration, and chronic nature of damage situations (Section 1.4.3). On public lands, a history of loss may be sufficient for determining that preventative work would be appropriate. On private land, the landowner/resource owner determines when the level of tolerance has been reached and may take any lethal and/or non-lethal action determined appropriate that is legal per state and federal law.

The number of variables involved in determining the point at which a private entity or a government wildlife agency, for example, requests assistance from APHIS-WS for IPDM preclude the ability or requirement to set a pre-determined threshold before a need is determined to exist and lethal and/or non-lethal action is requested and taken. WS-Montana is not responsible for or required to assess the economic value of a particular loss or threat of loss before taking a PDM action, and WS-Montana policy is to respond regardless of the requestor's threshold of loss.

Therefore, this alternative is not considered in detail.

2.5.8 No PDM at taxpayer's expense (PDM should be fee based).

Some persons feel that WDM should not be provided at the expense of taxpayers or that it should be fee based. A common argument for public funded WDM is that the public should bear responsibility for damage to private property caused by pubic wildlife. WS was established by Congress as the agency responsible for providing WDM to the people of the United States. Funding for WS come from a variety of sources in addition to federal appropriations. Such nonfederal sources include State general appropriations, local government funds (county or city), livestock associations, Indian tribes, and private funds which are all applied toward program operations. Federal, state, and local officials have decided that PDM should be conducted by appropriating funds. Although not required by law, the WS-Montana program currently requests cooperative local government or private funding to cover about 50% of the program's management services are, in essence, "fee based" to a relative high degree for a federal program. Additionally, WDM is an appropriate sphere of activity for government programs, since wildlife management is a government responsibility.

2.5.9 Use Regulated Hunting and/or Trapping to Reduce Predator Damage

MFWP can and has used regulated sport hunting and trapping by private individuals as an effective population management tool in areas where predators are causing damage and/or adversely affecting wildlife populations managed by MFWP. State-sponsored sport hunting and trapping programs can be one of the most efficient and least expensive techniques for managing populations over broad areas, but not necessarily within localized problem spots. In addition, this alternative is not necessarily effective for addressing localized predator damages and threats at the time the problem is occurring. Hunting is usually conducted in the fall and winter, when damage often occurs in the spring and early summer (Ray et al. 2005b). In addition, regulated hunting and trapping is often not allowed in urban or suburban areas because of safety concerns and local ordinances (Timm and Baker 2007).

Under the proposed action and the alternatives that allow for technical assistance in lethal methods, WS-Montana may certainly recommend to MFWP that a hunting or trapping season and an increase in regulated harvests may be helpful in reducing depredation in certain areas, if appropriate.

However, this alternative is not within the authority of APHIS-WS to implement. For all of these reasons, the use of regulated hunting and trapping is not an alternative evaluated in detail.

2.5.10 Live-Trap and Relocate Individual Predators Causing Damage

Under this alternative, all requests for assistance would be addressed using live-capture methods or the recommendation of live-capture methods. Predators would be live-captured using immobilizing drugs, live-traps, cages, or nets. All predators live-captured through direct operational assistance by WS-Montana would be relocated. In accordance with state law, relocation of wildlife must be approved by the MFWP under specific circumstances (Section 1.7). Therefore, the relocation of predators by WS-Montana would only occur as directed by the MFWP.

Relocating wildlife, particularly animals like bears and mountain lions that have learned to take advantage of resources and habitats associated with humans, could move the problem from one area to another, or the relocated animal could return to its original trapping site. MFWP generally does not authorize the relocation of smaller predators because of the healthy size of the populations statewide and the high risk of moving the problem along with the animal. Larger predators such as bears, mountain lions and wolves are at times relocated, and MFWP reports these relocations on their website (http://fwp.mt.gov/).

WS-Montana could be requested and authorized by MFWP to relocate individual problem bears or mountain lions, as a component of any alternative that includes an active WS-Montana program.

Relocation is also discouraged by APHIS-WS policy (APHIS-WS Directive 2.501) because of concerns with spreading the damage problem to other areas, spreading disease, concern with the animal returning to the capture site, and concern that the animals may fail to survive in the new area.

Therefore, this alternative is not considered in detail.

2.5.11 Managing Predator Populations through the Use of Reproductive Inhibitors

Methods for reproductive control for wildlife include sterilization (permanent) or chemical contraception (reversible). Sterilization in the field can be accomplished surgically (vasectomy, castration, and tubal ligation) and chemically through: 1) hormone implantation (synthetic steroids such as progestins), 2) immunocontraception (contraceptive vaccines), and 3) oral contraception (progestin administered daily). Contraception requires that each individual animal receive either single, multiple, or even daily treatment to successfully prevent conception.

Research into the use of these techniques consists of laboratory/pen experimentation to determine and develop the sterilization or contraceptive material or procedure, field trials to develop the delivery system, and field experimentation to determine the effectiveness of the technique in achieving population reduction. Prior to implementation, chemical contraception products must be registered and approved by the appropriate federal and state regulatory agencies. Research into reproductive control technologies has been ongoing, and the approach will probably be considered in an increasing variety of wildlife management situations by wildlife management agencies.

(Bromley and Gese 2001 a,b) conducted studies to determine if surgically-sterilized coyotes would maintain territorially and pair bond behavior characteristics of intact coyotes, and if predation rates by sterilized coyote pairs would decrease. Their results suggested that behaviorally, sterile coyote pairs appeared to be no different than intact pairs except for predation rates on lambs. Reproductively intact coyote packs were 6 times more likely to prey on sheep than were sterilized packs (Bromley and Gese 2001 b). They believed this occurred because sterile packs did not have to provision pups and food demands were lower. Therefore, sterilization could be an effective method to reduce lamb predation if enough alpha (breeding) pairs could be captured and sterilized. During Bromley and Gese (2001), they captured as many coyotes as possible from all packs on their study area; they controlled coyote mortality on their study area, and survival rates for coyotes were similar to those reported for mostly unexploited coyote populations, unlike most other areas. However, the authors concluded that a more effective and economical method of sterilizing resident coyotes was needed to make this a practical management tool on a larger scale (Bromley and Gese 2001).

Jaeger (2004), Mitchell et al. (2004), and Shivik (2006) also describe the problems with chemical or physical sterilants for alpha coyotes for reducing livestock depredation during the denning season. The primary problems involve identifying and capturing the alpha pair, which are very difficult to capture, rather than beta and transient animals, which do not perform the depredations within packs with stable social structures. Capturing and sterilizing all animals, hoping that the alpha individuals are included, is extremely expensive and time-consuming.

Currently, no reproductive inhibitors are available for use to manage most large mammal populations (Mitchell et al. 2004). Given:

- The costs associated with live-capturing and performing physical sterilization procedures on large mammals;
- The need for at least one and possibly multiple captures of individual animals for application of chemical contraception;
- The lack of availability of chemical reproductive inhibitors for the management of most mammal populations;
- Lack of research on the environmental effects of chemical sterilants and chemical contraception;
- The level of unknowns and disagreements within the professional wildlife management community regarding practicality of use, effectiveness, and potential impacts;
- The considerable logistic, economic, safety, health, and socio-cultural limitations to the use of fertility control on free-ranging predators.

APHIS-WS will monitor new developments and, where practical and appropriate, could incorporate reproductive control techniques into its program after necessary NEPA review is completed.

However, at this point, WS-Montana would neither use nor recommend the use of reproductive inhibitors to reduce or prevent reproduction in mammals responsible for causing damage. Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics, such as longevity, age at onset of reproduction, population size, and biological/cultural carrying capacity; habitat and environmental factors such as isolation of target population, cover types, and access to target individuals; socioeconomic; and other factors.

Therefore, this approach is not considered for further analysis in this EA.

2.5.12 Use Only Non-lead Ammunition

Effects on various resources from the use of lead ammunition are discussed in Section 3.10.2 of the EA, and a risk assessment for lead use in wildlife damage management (USDA Wildlife Services 2017h).

USDA, APHIS, Wildlife Services use of lead ammunition is a small fraction of total lead contamination from many sources. WS-Montana and many other state programs have investigated the availability of effective and accurate non-lead ammunition, and have found that such ammunition is not readily available for the wide variety of firearm types used in Montana and elsewhere, in the appropriate calibers. Non-lead ammunition is also more expensive.

WS-Montana will follow Department of Interior USFWS policy for eliminating the use of lead ammunition for management and research activities on lands and waters within the National Wildlife Refuge System under their jurisdiction (U.S. Fish and Wildlife Service 2016c). This policy requires non-lead ammunition to be used by employees of the USFWS, USDA APHIS, other federal agencies, state agencies, universities or private contractors for study and research, dispatch of feral or trespass animals when authorized, and dispatch of injured animals. It does not apply to public hunting on refuges or taking of free-ranging animals that threaten human safety or welfare of wildlife, especially if using lead-free ammunition would result in prolonged unrelieved pain and suffering of the animal.

WS-Montana continues to review the availability and performance of non-lead ammunition options relative to program safety and ammunition performance needs. As effective ammunition becomes available, WS-Montana will consider its use where appropriate. If WS-Montana were to use less lead ammunition, impacts would be less than those evaluated in Section 3.10.2. Consequently, this EA would still be valid if WS-Montana began using more non-lead ammunition.

2.5.13 Conduct Short-Term Suppression of Populations with Goal of Long-Term Eradication

An eradication alternative would direct all WS-Montana's program efforts toward long-term elimination of selected predator populations wherever a cooperative agreement has been initiated with WS-Montana. Eradication of a native predator species is not a desired population management goal of state or federal agencies and is outside the authority of APHIS-WS. WS-Montana does not consider eradication or suppression of native wildlife populations a responsible or effective strategy for managing predator damage because APHIS-WS policy and authority is to manage offending animals or multiple animals within the area of damage. MFWP has the authority to manage population levels of regulated species of wildlife through hunting and trapping seasons and depredation permits. WS-Montana may assist MFWP as its agent for meeting specific MFWP management objectives when requested (Section 1.8.1), but that type of activity is very infrequent and generally in small areas for protection of specific subpopulations of selected game animals consistent with MFWP management objectives set with public input (Section 1.11.5).

Therefore, this alternative will not be considered in detail.

2.5.14 Conduct Supplemental or Diversionary Feeding

Supplemental feeding involves providing additional food resources, such as food plots or bait stations, either during certain annual periods when damage is occurring or on a year-round basis to lure the animal away from the locations of protected resources (Section 1.11.3). This alternative is inefficient at best, and would most likely lead indirectly to increased damage. Supplemental feeding of carnivores would require a ready and consistent supply of meat, including animal carcasses, and placing those carcasses in areas that predators may be using. These sites could become a public nuisance, inappropriately attract large numbers of predators to a small area, increase intra- and inter-species competition and potential disease risks, and require a large and continuous effort.

In addition, supplemental feeding may increase predator populations and alter their natural diets (Fedriani et al. 2001, Newsome et al. 2015); decrease survival rates of targeted populations when food subsidy is removed (Bino et al. 2010, Newsome et al. 2015); predator populations no longer cycle with prey populations, changing life history parameters such as reproduction and social structure, size of home ranges, activity, and movements (Newsome et al. 2015); change interactions with other predator species, and create long-term changes in disease transmission (Newsome et al. 2015).

Therefore, this alternative is not considered in detail.

2.5.15 Conduct Biological Control of Predator Populations

The introduction of a species or disease to control another species has occurred throughout the world. Unfortunately, many of the introduced species become invasive species and pests themselves. For example, in Hawaii, the Indian mongoose (*Herpestes auropunctatus*) was introduced to control rats (*Rattus* spp.), but caused declines in many native Hawaiian species instead, primarily because the target species were nocturnal and mongoose are diurnal. WS-Montana is not authorized to conduct this type of work and would not use this method for IPDM.

Therefore, this alternative is not considered in detail.

2.5.16 Use Lithium Chloride as an Aversion Agent for Coyote Depredating on Sheep

Lithium chloride has been tested as a taste aversion agent to condition coyotes to avoid livestock, especially sheep. Despite extensive research, the efficacy of this technique remains unproven and is highly variable (Conover et al. 1977, Sterner and Shumake 1978, Burns 1980, Burns and Connolly 1980, Burns 1983, Horn 1983, Johnson 1984, Burns and Connolly 1985). Some studies report success using lithium chloride (Gustavson et al. 1974, Ellins and Martin 1981, Gustavson et al. 1982), while other studies have shown lithium chloride to be ineffective, especially in field situations (Conover et al. 1977, Burns and Connolly 1980, Burns 1983, Burns and Connolly 1985) and controlled experiments (Sterner 1995). The United States General Accounting Office General Accounting Office (2001) reported "…while the coyotes learned not to eat lambs, they still killed them."

In addition, lithium chloride is currently not registered by EPA for use by WS-Montana or MFWP, and therefore cannot be used or recommended for this purpose. If a product containing lithium chloride is registered in Montana to manage predator damage and if the product is proven effective in reducing predation rates, the use of the lithium chloride could be subsequently evaluated as an available method that could be used to managing damage. If WS-Montana considers using a product containing lithium chloride, WS-Montana would update its NEPA analysis accordingly.

Therefore, this alternative is not considered in detail.

2.5.17 All Losses Confirmed by an Independent Entity (Not WS-Montana)

Some commenters request that all livestock losses be confirmed by an entity independent of WS-Montana prior to WS-Montana taking any action, especially lethal action.

In order to accurately identify the species, and even the animal(s) that has caused a damage or depredation situation, the on-site verification must occur quickly after that event has occurred before the evidence is degraded or removed/consumed by a returning predator. Action to remove the offending animal must also occur quickly, in order to actually address the specific animal, and not, for example, a scavenger. Waiting for an independent entity to verify a depredation event and the animal(s) creating it may result in the inability to verify at all. Also, no entity with the expertise, experience, training, and resources exists in Montana, other than commercial enterprises that focus on predators less than or equal to the size of coyotes. This requirement is also outside the scope of this EA as WS-Montana has no authority to implement an independent process for verifying livestock losses.

Requiring entities other than WS-Montana to confirm losses could delay responding to requests for assistance, and introduce considerable variability in reporting data. Such a delay could result in individuals deciding to take action, which may result in more predators taken than the offending animal, such as scavengers or other predators in the area, or the offending species. It could also prevent resolution of the problem because the remaining evidence might be too degraded for anyone to make a reliable determination of the cause.

Therefore, this alternative will not be considered in detail.

2.5.18 Producers Avoid Grazing Livestock in Areas of Predator Activities and Ensure Herders Constantly Present

APHIS-WS does not have authority to manage grazing or compel ranchers to conduct any activity. However, WS-Montana may provide technical assistance in the form of recommendations on animal husbandry methods to reduce risk of depredation.

Producers, to the extent practicable, work to avoid grazing livestock near predator dens and rendezvous sites. However, producers have no control over whether or not predators establish dens or rendezvous sites near their livestock, and with some common predators, such as coyotes, it may be virtually impossible to avoid grazing “near” dens, especially for producers grazing on private lands. Producers may not have the option to move their livestock elsewhere either because they have limited access to substitute grazing lands or because the land management agency establishes the timing and movements for permitted livestock. To minimize environmental concerns on grazing lands, cattle are not maintained in tight herds as it often is with bands of sheep, further limiting options to move livestock. In dry years, in order to minimize risk of adverse effects on range, producers may spend shorter times in any given area, but they then need to use all or most portions of their allotments instead of avoiding areas with a history of predator conflicts.

WS-Montana also does not have authority to require ranchers to hire herders for livestock, although it might recommend that strategy as part of technical assistance using the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b). Nonetheless, sheep producers routinely use herders with their animals to keep them together in a band and moving through the grazing areas. Due to the dispersed nature of cattle grazing, herders are not as effective a management strategy, but range riders can help reduce risks of predation by moving cattle away from areas of high predation risk and promptly identifying animal health and predation incidents so they can be addressed to minimize livestock losses (Parks and Messmer 2016). In Montana, cattle producers are increasingly using range riders in occupied wolf and grizzly bear habitat.

WS-Montana responds to requests for IPDM assistance from producers with large herds/flocks that graze on open range and producers with small herds/flocks in fenced pastures. Use of herders and range riders (Parks and Messmer 2016) represents a substantial financial obligation and may not be cost effective for producers with smaller herds/flocks. For producers with small flocks in fenced pastures, it may be better to incur a one-time investment in installing quality fencing that would last for years than the annual expense of a herder.

Instead of mandating a specific set of management alternatives for all producers, the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) and IPDM process would be used by WS-Montana under alternatives that involve some level of WS-Montana involvement in IPDM.

2.5.19 Use Bear Repellents

Capsaicin (concentrated red pepper spray) has been tested and used effectively on black bears and grizzly bears, primarily as an emergency personal protective repellent primarily by recreationists in the backcountry. The spray range on most products is less than 30 feet, so capsaicin is only effective in close encounters and is not appropriate for long-term management of bear damage or threats to public and pet safety. The use of capsaicin pepper spray is not effective IPDM tool and, since it must be used at close range to the depredating animal, may be extremely dangerous.

Therefore, this alternative is not considered in detail.

2.5.20 Livestock Producers Pay 100% of WS-Montana Assistance Involving Lethal Removal

This is discussed in Section 1.13.6.3. The intent of this alternative is to ensure that lethal removal is not subsidized by federal taxpayer funds, thereby encouraging livestock producers to decide whether their funds are more effective if applied to non-lethal methods.

Under all alternatives in which WS-Montana provides lethal and/or non-lethal assistance, preference is already given to non-lethal methods in accordance with WS Directive 2.101. In many instances, WS-Montana is contacted after entities have unsuccessfully attempted to resolve their damage or threats on their own with non-lethal and/or lethal methods. APHIS-WS is authorized by federal law and funded by both Congressional appropriations and funds provided by entities that enter into cooperative agreements with APHIS-WS state offices for assistance.

WS-Montana already provides technical support to all requesters and operational support (Alternative 1), including lethal assistance to some degree under all alternatives as determined appropriate, except Alternative 5.

Therefore, this alternative is contrary to agency policy and will not be considered in detail.

2.5.21 WS-Montana Prohibited from Operating on Federal Lands

The USFS and BLM recognize the importance of effective IPDM actions on lands under their jurisdiction. USFS and BLM maintain MOUs with APHIS-WS at the national level (Section 1.8.2). These MOUs provide for direct requests from livestock permittees or state agencies to the respective APHIS-WS state agency for preventive and corrective assistance.

Per the national interagency MOUs, the agencies meet annually to cooperatively develop work plans, including designating appropriate restrictions to ensure that IPDM actions do not conflict with land use plans.

Producers leasing grazing allotments on federal lands, natural resource managers working to protect sensitive or ESA-listed species, and federal agency officials responding to threats to human/pet health or safety associated with predators on federal lands that they manage have legal access to the same types of damage management methods as would be used by WS-Montana, with the exception of DRC-1339. Between FY 2013 and FY 2017, only 1.4% of coyote take by M-44s has occurred on public lands (BLM=1.2%; state lands=0.2%); 98.4% of coyote take in Montana by M-44s occurs on private lands. Only 7.1% of all coyote take by WS-Montana in the state has occurred with M-44s because of limited application. M-44s are primarily used to target coyotes that have proven difficult to remove using other methods.

IPDM can and is being conducted on federal lands by entities other than WS-Montana. Public hunting and trapping as regulated by MFWP legally occurs on public lands unless otherwise restricted (such as in national parks).

Some predator species, such as coyotes, may be taken by the public, permittees, or other agencies experiencing depredation in the same manner as actions by WS-Montana (except for the use of DRC-1339) without any requirement to report take to MFWP unless they are taken under an aerial shooting permit issued by MDOL. Depending on the training and experience of the individuals conducting the work, selectivity of these actions for target species and target animals, especially older territorial adult coyotes that are typically more difficult to capture than younger individuals, may be lower than for a program conducted by trained personnel from WS-Montana (Sacks et al. 1999a, Sacks et al. 1999b, Larson 2006).

This issue is outside the scope of APHIS-WS authority. Therefore, this alternative is not considered in detail in this EA.

2.5.22 No IPDM within any Designated Wilderness Areas (WAs) or Wilderness

Study Areas (WSAs)

Currently, WS-Montana's work in most WAs and WSAs ranges from no activity to seasonal IPDM activities based upon requests for service (Alternative 1; Section 3.11). For most WAs and WSAs, WS-Montana is requested to protect livestock, health and human safety, or T&E species. While requests for service in WAs and WSAs occurs on an infrequent basis, the potential exists that WS-Montana may be requested to work, as described in Sections 1.8.2 and 1.9.4. When requested to respond, WS-Montana follows all applicable laws, APHIS-WS policies, MOUs, regulations, management plans, MRAs, and land management agency policies. WS-Montana coordinates all activities in WAs and WSAs with the appropriate land management agencies in Annual Work Plans (Section 3.11.3.3).

WS-Montana coordinates with federal WAs and WSAs land managers so that proposed IPDM activities are consistent with the management needs for each individual area. Work in wilderness must be consistent with (a) the Wilderness Act, (b) each area's wilderness management plan, (c) the land management agency's wilderness management policies, (d) each area's individual wilderness legislation (which might contain special provisions applicable only to that particular wilderness area), and (e) IWDM MOUs between APHIS-WS and the wilderness management agency. Proposed activities in WSA must be consistent with BLM or USFWS policy and management plan in which WSAs are managed to preserve wilderness character for possible future wilderness designations.

Due to the low likelihood and duration of work in WAs and WSAs, as well compliance with the procedures and policies outlined above, WS-Montana has negligible effects on these areas (Section 3.11,).

Since WS-Montana activities in WAs and WSAs has negligible effects under the current activity level (Alternative 1), it is not reasonably foreseeable that an alternative with no PDM in these areas would have significantly different effects. Some wilderness, proposed wilderness areas, and WSAs in Montana have historic grazing allotments. The minor amount of IPDM activities that could be conducted by WS-Montana in wilderness, proposed wilderness, or WSAs conforms to legislative guidelines and MOUs between APHIS-WS and the responsible land management agencies.

Authorization for IPDM on WAs and WSAs is determined by statutes and policies under the authority of USFS, BLM, and USFWS. Additionally, this alternative does not meet the purpose and need. Therefore, this alternative is not considered in detail.

2.5.23 WS-Montana Contracts IPDM Activities to the Commercial Sector or Defers All IPDM Activities to MFWP

This alternative requires WS-Montana to award and oversee contracts for predator damage management activities to the commercial/private sector; WS-Montana would not conduct any technical or direct lethal or non-lethal assistance. All legally authorized methods would also be authorized in such contracts. WS-Montana would retain contracting responsibilities, provide oversight to ensure that IPDM is implemented according to the statement of work, and document target and non-target take as reported by the contractor. As the authorized federal agency, WS-Montana would continue to be responsible for environmental and NEPA compliance. Private contractors would not be contracted to use DRC-1339.

MFWP is often the first to be requested and to respond to damage caused by bears and cougars, and can either do the work itself, hire commercial companies, and/or enter into an agreement with WS-Montana. Any IPDM work not conducted or authorized by WS-Montana or by another federal agency would not require compliance with NEPA.

WS-Montana does not contract its authorized activities to other entities, including commercial entities. MFWP and its agents may already be hired directly by requesters to conduct IPDM activities. WS-Montana would not assume any responsibility or liability for actions conducted by any other entity.

Therefore, this alternative will not be considered in detail.

2.5.24 Modify Habitats to Reduce Predation

WS-Montana may recommend habitat modification as part of its technical assistance activities (WS-Montana does not conduct this type of activity itself) in all alternatives having WS-Montana involvement. The land/resource owner is responsible for ensuring that any necessary permits are acquired prior to taking any such action on their private land. Also, federal and state land management agencies have the authority to conduct habitat management.

As this strategy is already included in all the alternatives considered in detail, except the "No WS-Montana Program" alternative (Alternative 5), this alternative will not be considered further as an independent alternative.

2.5.25 Make Supplemental Payments to Livestock Producers: The Marin County Livestock Protection Program

Under the current Marin County, California Livestock Protection Program, qualified ranchers are provided cost-share funding to assist in the implementation of non-lethal management methods to reduce depredation such as fencing, guard animals, scare devices, or changes in animal husbandry. The program is described in more detail under Section 1.13.5.

A study evaluating the effectiveness of the Marin County program (Larson 2006) found several shortcomings. Larson (2006) indicated that more coyotes have been killed during the Marin County Program compared to the standard APHIS-WS cooperative program, as landowners and their agents are not prohibited from killing coyotes while also participating in the County's program. Landowners are rarely trained or experienced in professional trapping techniques and are more likely to capture non-target species during their efforts (Larson 2006). The Marin County program does not require landowners to record use of lethal methods or take numbers. There is no way to quantify the take of target and non-target animals nor evaluate the environmental impacts of such take. In the first five years the current program, on average, cost Marin County 1.3 times the cost of the cooperative APHIS-WS IPDM program in its highest year (Larson 2006). It does not provide trained personnel to apply cost-shared equipment in the field, nor does it address several of the needs for action that WS-Montana identified in Chapter 1 (Sections 1.11.2

through 1.11.5). Unlike Montana, Marin County does not have prevalent mountain lion, black bear, grizzly bear, or wolf populations or conflicts with these species and livestock.

Based on the limitations of the Marin County program summarized above, the failure of the program to address all needs for action presented in Chapter 1, and the fact that APHIS-WS has no control over the authorities, decisions, and budget of state, county, and local governments, WS-Montana has determined that detailed analysis of this alternative would not provide substantive new information to aid decision-making and will not be conducted at this time.

2.5.26 WS-Montana Should Subsidize Non-Lethal Methods Implemented by Resource Owners

Under the current program (Alternative 1), WS-Montana subsidizes some non-lethal IPDM methods in the form of loaning or distributing equipment, under very limited circumstances. For example, electric netting fences, propane cannons, pyrotechnics, and cage traps have been loaned or distributed by WS-Montana to livestock producers on rare occasions. This activity is also incorporated into Alternatives 2 and 3. The "subsidy for non-lethal methods" alternative could include covering the cost of livestock guarding animals, purchasing materials for non-lethal methods (e.g., fencing or fladry), staffing range riders to protect livestock at night, and loaning or permanently provisioning frightening devices (e.g., pyrotechnics or electronic guards).

Although we recognize the appeal of this alternative, unfortunately it has some limitations. Cooperators rely on WS-Montana for IPDM, which includes both non-lethal and lethal methods. At present, cooperators often purchase and utilize non-lethal methods prior to contacting WS-Montana to address IPDM needs. WS-Montana is actively seeking cooperative funding to increase the use of non-lethal methods (see below), but funding is currently not sufficient to allow widespread subsidies for use of nonlethal methods.

Additionally, non-lethal IPDM methods are extremely limited for some applications (e.g., predation on range herds of cattle), and, in some cases, depredation persists despite implementation of practical and effective non-lethal methods. Most often, WS-Montana's assistance is requested once predation has reached the cooperator's threshold of losses and non-lethal methods have been proven ineffective.

WS-Montana is a cooperatively funded program with approximately half of its funding comprised of non-appropriated (non-federal) dollars. Cooperators provide the direction to WS-Montana on the types of services they want delivered with the funding they provide, and it is implemented in accordance with program policies. Although WS-Montana does loan some deterrence equipment such as turbo fladry, cooperators request that WS-Montana focus its efforts on those services that the public is less skilled or proficient in doing. When cooperators request their funding be used for non-lethal only methods, WS-Montana can increase its capacity to implement non-lethal methods. For example, in 2018 WS-Montana hired a range rider and a fencing technician. These positions began as 100% cooperatively funded. Cooperators rely on WS-Montana to provide technical assistance needed for individuals (including individuals supplementing

WS-Montana efforts) to use their own resources and efforts. Use of appropriated dollars to subsidize the purchase of non-lethal methods would impact the support infrastructure which enables other entities to cooperate with WS-Montana. The State of Montana provides some subsidies for non-lethal methods to resolve damages from the predator species covered in this EA through a grant program administered by the MLLB.

Given that WS-Montana does not have the anticipated resources needed to fully implement this alternative statewide, and that WS-Montana would not be able to adequately meet the full purpose and need for action, a "subsidy for non-lethal methods" alternative will not be analyzed in detail.

2.5.27 Use of Trap Tranquilizer Devices (TTDs) by WS-Montana

NWRC developed trap tranquilizer devices (TTDs) as a means of sedating animals captured in foothold traps to reduce the potential for self-inflicted injuries while held in the trap. TTDs are small rubber nipples fastened to the trap jaw filled with the tranquilizer propiopromazine HCL (Savarie et al. 2004). When captured, predators instinctively bite the trap tab, ingest the immobilizing drug, and are sedated. Used properly, the sedative propiopromazine HCL does not render the animal unconscious.

Considerations for species, size, and pooled water may restrict the use of a TTD if a sedated animal was to have the potential to access such water. This scenario could occur if a trap was set adjacent to a body of water or a captured animal pulled the trap loose from its staked anchor, with the trap attached to a grapple hook/ drag per requirements, allowing it to travel a short distance before full or partial sedation effects occurred. Another environmental concern is the ability of drugged and restrained animals to defend itself from predators and parasites. WS-Montana is not currently using TTDs given these concerns for animal welfare.

3 Environmental Consequences

Chapter 3 provides the information needed for making informed decisions in selecting the appropriate alternative for meeting the need for IPDM in Montana as identified in Chapter 1. Chapter 3 begins by identifying the types of impacts (effects) that will be evaluated, the specific issues that will be analyzed in detail, environmental resources that will be studied, and what would occur if WS-Montana were less available to provide IPDM assistance. Each issue section addresses a separate environmental resource and includes background information, an evaluation of the impacts on those resources, and a conclusion. Determination of significance of the impacts predicted in this chapter does not occur in this EA, but is made by the APHIS-WS decision-maker and documented in the appropriate decision document.

This chapter analyzes the environmental consequences of each of the five alternatives discussed in Chapter 2. The proposed action/no action alternative (Alternative 1) is assessed against the environmental baseline, which is described in Section 1.10.3. Alternative 1 is then used as the benchmark for comparisons among the Alternatives. Alternatives 2, 3, 4, and 5 are compared to the proposed action (Alternative 1) for each issue to determine if real or potential impacts would be higher, lower, or approximately the same.

3.1 What Kinds of Effects are Evaluated in this Chapter?

Chapter 3 examines the direct, indirect, and cumulative impacts of each of the alternatives on the biological, physical, and sociocultural aspects of the human environment (issues). Direct effects are caused by the action and occur at the same time and place. Indirect effects, which are caused by the action and are later in time and farther removed in distance (Council on Environmental Quality 2017)(40 CFR 1508.8). A cumulative impact results from the incremental impact of the action when added to other past, present, and reasonably future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (Council on Environmental Quality 2017)(40 CFR 1508.7).

The consideration of past actions may be considered in a cumulative impact analysis as the baseline to which the impact associated with the proposed action or alternative is compared and contrasted. It may also provide a context of the trends over time related to direct or indirect effects associated with the proposed action or alternatives or may illuminate or predict future direct or indirect effects of the proposed action based on past experience with similar types of proposed actions (Council on Environmental Quality 2005). Thus, the baseline impacts are those for Alternative 1, the proposed action/no action alternative, as described in Section 1.3.1.1.

3.2 What Issues are Analyzed in this Chapter?

According to the Council on Environmental Quality (CEQ), NEPA documents should evaluate "*ecological…, aesthetic, historic, cultural, economic, social, [and] health*" effects. Environmental issues are the resources that may be affected by the proposal, or concerns about the risks to humans from implementing IPDM activities. The issues in this section were identified based on APHIS-WS experience, agency and tribal outreach, and/or from public comments on similar APHIS-WS actions. Many of the issues are evaluated in greater detail than the expected effects warranted because they are concerns that have been commonly raised by the public during similar APHIS-WS NEPA processes (USDA Wildlife Services 2011;2014a;2016). The following issues are analyzed in this chapter in the order outlined.

3.2.1 Effects on Populations of Predator Species Taken Intentionally (Section 3.5)

This issue drives the analysis of the direct effects of WS-Montana's intentional lethal IPDM activities, and the cumulative effects that include all other known sources of predator mortality. WS-Montana, its cooperating agencies, and the public are concerned with the effects of removals on the viability of predator populations. The effects on each species is evaluated using the best available information including the scientific literature and detailed take information from WS-Montana's MIS database and reported take from MFWP, MDOL, and USFWS databases.

3.2.2 Effects on Species that May Be Taken Unintentionally

3.2.2.1 ESA-listed Threatened and Endangered Species (Section 3.6)

WS-Montana consults with the USFWS when its activities may affect any federally-listed threatened or endangered species. This issue evaluates the potential for effects on such listed species. ESA Section 7 consultations with the USFWS are relied on for evaluating potential effects.

3.2.2.2 Unintentional Take of Other Species (Section 3.7)

Other non-target species discussed are those recently taken by WS-Montana during IPDM, as well as those determined to be most likely to be taken in the future. These determinations are based on APHIS-WS experience, previous APHIS-WS EAs, and public comments on those EAs. These include predator species which may directly impacted due to unintentional take, as well as prey species which may be indirectly affected by predator removal. Analysis of unintentional lethal and non-lethal take, formerly referred to as non-target take, is based on WS-Montana take data and evaluated within the context of their population trends, other consumptive uses, and natural sources of mortality.

3.2.3 Effects of IPDM on Ecosystem Function (Section 3.8)

This issue concerns the impacts on the ecosystem due to the removal of predators during PDM and addresses complex interrelationships among trophic levels, habitat, biodiversity, and wildlife populations. These are inherently indirect and cumulative impacts. This issue has been routinely raised by the public during similar APHIS-WS NEPA processes (USDA Wildlife Services 2011;2014a;2016). The analysis of this issue is limited to the larger picture of the ecosystem effects, as opposed to effects on any particular species' population and is based on an extensive review of the relevant scientific literature and impact analyses on predator and non-predator species in Montana (Issues A and B).

3.2.4 Impact on Humaneness and Ethics Related to WS-Montana Use of IPDM methods (Section 3.9)

Humaneness and animal welfare as it relates to killing or capturing wildlife is an important and very complex issue that can be interpreted in a variety of ways. WS-Montana and the public are concerned about the humane treatment of animals, and people hold differing ethical values related to IPDM. The scientific literature related to the ethics of wildlife capture and lethal take in recreational, research, and predator control activities, and the apparent humaneness of the use of mechanical, non-chemical, and chemical lethal and non-lethal take methods are summarized, discussed, and analyzed.

3.2.5 Effects of IPDM Methods on the Environment and Their Risks to Human/Pet Health and Safety (Section 3.10)

This issue drives the analysis of the effects of WS-Montana's use of IPDM methods (mechanical, non-chemical, and chemical methods, Appendix A) on environmental resources including soil, water, air, plants, and invertebrates. It also assesses the risks from using the IPDM methods on human and pet health and safety by addressing the following concerns:

- Potential exposure of WS-Montana employees to disease from handling animals
- Potential for WS-Montana employees, the public, or surface water to be exposed to hazardous chemicals (*e.g.*, lead, pesticides, immobilizing/euthanasia chemicals, and pyrotechnics)
- Potential for WS-Montana employees or the public to be exposed to hazardous mechanical tools (traps, snares, and firearms)
- Employee/crew safety during aerial PDM operations
- Risk of employees being attacked or bitten by captured animals
- Potential for impacts to communities, including consideration of Environmental Justice (E.O. 12898); and children (E.O. 13045)
- Potential for WS-Montana PDM activities to impact pets and domestic animals (*e.g.*, due to non-target take)

3.2.6 Impacts on Special Management Areas (Section 3.11)

Analyses of impacts related to IPDM actions in special management areas in Montana focuses on understanding the types of activities allowed in special management areas with an emphasis on Wilderness Study Areas and congressionally-designated Wilderness. The evaluation includes discussion of how proposed IPDM activities in Wilderness and other specially managed lands would be found to be consistent with the objectives for each special management area.

3.2.7 Cultural Impacts Including Impacts on Native American Cultural Uses, Hunting, Non-Consumptive Uses, and Aesthetic Impacts (Section 3.12)

Some members of the public may be concerned that WS-Montana IPDM activities could conflict with cultural and spiritual values, recreational activities such as hunting and fishing, and non-consumptive uses such as wildlife viewing and photography. There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners, native tribes, or neighboring residents.

Aesthetics is a philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is subjective in nature and is dependent on what an observer regards as beautiful. Wildlife generally is regarded as providing economic, recreational and aesthetic benefits (Decker and Goff 1987) and the mere knowledge that wildlife exists is a positive benefit to many people. There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners or neighboring residents. An example of concerns pertaining to aesthetic impacts might include that the noise (e.g., from aircraft) or seeing evidence of IPDM activities would adversely impact aesthetic enjoyment of activities such as hiking on public lands.

Native American cultural practices: Native American tribes in Montana use natural resources for food, income and cultural practices. This Section also addresses potential for each of the alternatives to impact tribal uses of and relationships with wildlife resources and natural ecosystems.

3.2.8 WS-Montana Objectives for IPDM Activities (Section 3.14)

This section determines whether the Alternatives meet the goals and objectives of the proposal (as outlined in Section 1.5.2) by referencing the sections of the EA that address each objective. Meeting the objectives of IPDM is not an environmental impact assessment issue. It is included to evaluate program effectiveness, facilitate decision-making, and aid the public in understanding how the alternatives compare.

3.3 What Issues Are Not Considered for Comparative Analysis and Why?

The following issues have been commonly raised by the public during similar APHIS-WS NEPA processes (USDA Wildlife Services 2011;2014a;2016) and although they are issues that are considered in the development of this EA, they are not considered in the detailed discussion for the reasons identified. In addition, the following environmental resources are not evaluated in detail because the agency has found that these resources are not significantly impacted by APHIS-WS and WS-Montana operations, based on similar APHIS-WS NEPA processes in the Western United States (USDA Wildlife Services 2011;2014a;2016).

3.3.1 APHIS-WS activities could conflict with ongoing wildlife field research:

Concerns that APHIS-WS IPDM activities could interfere with ongoing agency or academic wildlife research have been raised. WS-Montana coordination with MFWP, tribal, federal, or state agency researchers would typically identify such ongoing research so potential conflicts could be avoided or mitigated. Such research occurring on USFS or BLM lands would also be identified during development of the Annual Work Plan. For example, WS-Montana works with MFWP biologists to assist in radio-collaring wolves and grizzly bear. Data from these collaring efforts are used for research and monitoring purposes.

3.3.2 Accuracy of reporting intentional and unintentional take of animals:

Commenters have questioned the accuracy of APHIS-WS recording of the number of animals taken intentionally and unintentionally during field activities (USDA Wildlife Services 2011;2014a;2016). All APHIS-WS personnel are required to accurately report their field activities and technical assistance work in the MIS database, including all animals taken intentionally and unintentionally, whether lethally or released (WS Directive 4.205). Per APHIS-WS policy, supervisors are required to review recorded work tasks for accuracy and to monitor: 1) compliance with rules and regulations for the use of pesticides and other special tools and methods, and 2) adherence to permits, regulations, laws and policies pertaining to APHIS-WS actions. The report prepared by the USDA Office of Inspector General (OIG) on its audit of the APHIS-WS IPDM activities reviewed the accuracy of recording field activities, among other issues (Section

1.12.2). The audit concluded that APHIS-WS complied with all applicable federal and state laws and regulations regarding wildlife damage management. However, the audit found that MIS contained inaccurate information, including external party access and data entry errors. These conditions resulted in inflated take numbers and the transmission of inaccurate data to the public. APHIS-WS is committed to and actively addressing OIG recommendations intended to further reduce discrepancies (Office of the Inspector General 2015).

3.3.3 Environmental effects from the loss of individual animals:

Comments on previous APHIS-WS NEPA processes have urged APHIS-WS to analyze environmental impacts from the loss of individual animals, suggesting that the killing of any wildlife represents irreparable harm (USDA Wildlife Services 2011;2014a;2016). Under the current and proposed alternatives, an individual predator or multiple predators in a specific area may be lethally removed through WS-Montana IPDM activities. All WS-Montana IPDM activities are conducted under the authorization of, and in compliance with, federal and state laws for the protection of wildlife populations. Although we recognize that some people could find the loss of individual animals distressing, analysis in Chapter 3 indicates the current and proposed actions involving the removal of individual animals would not in any way cause direct, indirect, or cumulative irreparable harm or other environmental impacts on any of the wildlife populations involved in WS-Montana's operations, including ESA-listed species (see Sections 3.5, 3.6, and 3.8). Section 1.4.2 discusses the variety of values that people place on wildlife, including on individual animals. The ethics and humaneness of capture and removal of individual animals are evaluated in detail in Section 3.9.

3.3.4 WS's removal of coyotes exacerbates the livestock depredation problem because the coyote population reduction results in compensatory reproduction.

Although it is well supported that coyote reproduction increases as population size decreases (Connolly and Longhurst 1975a), WS is unaware of any data that would substantiate the speculation that unexploited coyote populations pose less risk to livestock than exploited populations. On the contrary, research on lamb and sheep losses with restricted or no PDM indicate coyote control is effective in reducing losses. This is supported by a review of the Government Accounting Office which concluded that "according to available research, localized lethal controls have served their purpose in reducing predator damage" (Government Accounting Office 1990).

3.3.5 Effects of Livestock Grazing on Riparian Areas and Wildlife Habitat as a "Connected Action" to WS's PDM Activities.

Some people have suggested that livestock grazing is "connected" to WS-Montana IPDM action, which implies that it either is an "interdependent part" of WS-Montana IPDM and depends on such IPDM for its justification (*i.e.*, that it is "automatically triggered" by WS-Montana PDM), or that it "cannot and will not proceed" unless WS-Montana IPDM occurs (40 CFR 1508.25). Both of these assertions are incorrect. Livestock grazing in Montana occurs on many private lands, as well as on BLM- and

USFS-identified grazing allotments, without any WS-Montana IPDM actions conducted on those allotments in a given year. Therefore, livestock grazing is not automatically triggered by WS-Montana IPDM, and it clearly can and does "proceed" in the absence of WS-Montana IPDM assistance.

Although some persons may view WS-Montana IPDM actions as causing "indirect" effects on rangeland and riparian areas by facilitating the continuation of livestock grazing in such areas, such livestock grazing takes place independent of WS-Montana activities. It is important to note that regulation or restriction of livestock grazing is outside the scope of decisions that WS-Montana has authority to make. In addition, IPDM activities will occur wherever livestock producers experience predation losses, whether it is on private, state, or federal lands, and whether or not WS-Montana is involved. Private land livestock grazing and its effects are part of the existing human environment, and is common and extensive.
Like livestock grazing and its impacts on the environment, PDM by nonfederal entities is considered part of the environmental baseline (Section 1.10.3) and, in the absence of any federal PDM assistance, does not have to comply with the requirements and provisions of NEPA. We believe that professional assistance by a federal government agency operating under strict federal and state laws and government policies and guidelines is less likely to result in unintended adverse effects on the environment.
It is certainly reasonable to assume that PDM by State or private entities would occur in the absence of assistance by WS-Montana. Thus, even if WS-Montana selected an alternative that precludes WS-Montana involvement, such a decision would have virtually no meaningful effect in changing the environmental baseline with respect to the impacts of grazing and/or IPDM actions. Federal land management laws all contain clauses protecting the rights of the States to maintain jurisdiction over the management of resident wildlife species.[1] It is our understanding that, unless regulated or restricted by the BLM, USFWS, or USFS, authorized Montana State agencies such as the MFWP and MDOL (or even private entities acting in accordance with State wildlife laws) could theoretically be authorized to control predators on BLM, USFWS, and USFS lands in the absence of any involvement by WS-Montana.

3.3.6 Historical resources:

Predator damage management methods and activities implemented by WS-Montana as described in Section 2.3.1 and Appendix A do not cause major ground disturbance and

[1] Multiple Use and Sustained Yield Act of 1960, 16 U.S.C. § 528 (MUSYA) (stating that nothing in the act "shall be construed as affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish on the national forests"); Federal Land Planning Management Act, 43 U.S.C. § 1732(b) (emphasizing that "nothing in this Act shall be construed as * * * enlarging or diminishing the responsibility and authority of the States for management of fish and resident wildlife"). The National Forest Management Act of 1976 explicitly incorporated the MUSYA. 16 U.S.C. § 1604(e)(1). The Wilderness Act provides that "nothing in this Chapter shall be construed as affecting the jurisdiction or responsibilities of the several States with respect to wildlife and fish in the national forests." 16 U.S.C. § 1133(d)(7).

generally do not have the potential to affect historic properties, districts, sites, and objects. WS-Montana has determined that its activities do not generally have the potential to affect historic properties and other cultural resources and are therefore not "undertakings" as defined by the National Historic Preservation Act (NHPA) (May 14, 2018). This determination is also based on outreach with federally-recognized tribes in Montana (Section 1.8.2), including compliance with EO 13175 and NAGPRA. In addition, as described in Section 1.8.2, WS-Montana closely coordinates all activities with land managers, including land management agencies who are responsible for identifying areas of potential conflict and avoidance. Therefore, NHPA consultation requirements have not been triggered based on past WS-Montana activities. In the unlikely event that an issue with cultural resources is raised during IPDM planning by a tribe or federal agency, or if WS-Montana were to identify a localized need to excavate soil, or have another potential effect on historic buildings, sites, or objects, NHPA could be triggered and WS-Montana would review its activities with the State Historic Preservation Office to determine the appropriate consultation needs. However, in these unlikely scenarios, WS-Montana would likely relocate its site activities to completely avoid any potential effects on cultural resources.

3.3.7 Environmental justice (E.O. 12898):

This executive order relates to the fair treatment of people of all races and income levels with respect to social, health, and environmental impacts. WS-Montana responds to all requests for assistance, regardless of race or level of income, and the contribution of federal funds can further assist such populations in addressing health and safety threats caused by predators and economic impacts from depredation and damage. As always, the disposal of carcasses, and the handling, use, and disposal of hazardous materials and chemicals are conducted per agency policy (Section 2.4) and federal and state law and regulations. Risks to human health and safety are discussed in Section 3.10.

3.3.8 Floodplains (E.O. 11988):

WS-Montana operations do not involve construction of infrastructure and would not impact the ability of floodplains to function for flood abatement, wildlife habitat, navigation, and other functions.

3.3.9 Visual quality:

WS-Montana operations do not change the visual quality of a public site or area. Although physical structures, such as fencing, may be recommended as part of technical assistance, they are not constructed by WS-Montana and therefore not under the agency's jurisdiction. WS-Montana may assist livestock producers with installing fencing (permanent or temporary) or fladry in small quantities as a non-lethal deterrent to predators and would be more likely to occur on private land but could occur on active grazing allotments on public land. Most of these barriers would be temporary for a short duration, and permanent fencing would occur only on private land. In the event that feral swine are discovered in the state, WS-Montana may temporarily deploy large cage or corral style traps to capture feral swine. These traps would likely be placed on private land. If these traps are set on public land, they will be set in such a way that they can be easily removed without adversely affecting the site.

3.3.10 General soils (except for Section 3.10.2 - environmental fate of lead in soils):

WS-Montana PDM operations do not often involve directly placing any materials into the soils or causing major soil disturbance. WS-Montana may assist livestock producers with installing fencing (permanent or temporary) or fladry in small quantities as a non-lethal deterrent to predators. Soils would be affected at permanent post hole locations, however WS-Montana does not frequently build permanent fencing. Soil disturbance from vehicle use is minimized because vehicles are used on existing roads and trails to the extent practicable and as required by land management agencies, landowners, or by law, and there is no construction proposed or major ground disturbance. Setting traps involves only minor surface disturbance, and equipment is set primarily in previously disturbed areas.

3.3.11 Minerals and geology:

WS-Montana PDM operations do not involve any major excavation, blasting, or contact with minerals that would result in change in the underlying geology of an area.

3.3.12 Prime and unique farmlands:

WS-Montana operations do not involve converting the land use of any kind of farmlands.

3.3.13 Water resources (see Section 3.10 regarding the use of lead ammunition and effects in wetlands):

WS-Montana PDM operations do not involve construction, major digging, dredging or filling, discharge of pollutants into waters of the U.S., or changes to flow of waterways. All chemicals used for IPDM are used, stored and disposed of in accordance with EPA and state requirements for the protection of the environment. WS activities would not cause erosion or sedimentation into water bodies. See also general soils and vegetation in this section. Therefore, IPDM would not affect water resources including water quality and wetlands, streams, ponds, or other waterbodies.

3.3.14 Air quality:

WS-Montana's emissions are from routine use of vehicles, airplanes, and very limited use of harassment devices using explosives, and therefore constitute a minimal contribution to pollutants regulated under the Clean Air Act.

3.3.15 Vegetation, including timber and range plant communities (except for federally-listed plant species, Section 3.6):

WS-Montana operations do not involve modification to any vegetation communities, nor do they involve intentional removal of trees or shrubs. WS-Montana's activities would have only a small potential for a negligible amount of plant disturbance (see Section 3.6.5 for a discussion of effects on T&E plant species). WS-Montana may provide technical assistance in the form of information or advice to land managers/owners to modify vegetation to help deter predators, however actions by the land managers/owners are not a WS-Montana responsibility.

3.3.16 Global Climate Change/Greenhouse Gas Emissions:

Global climate change is an important topic which needs to be considered. However, we believe that it does not warrant consideration as an "Issue" for comparative analysis. We have considered the topic of global climate change, and our analysis is provided below.

The State of the Climate in 2012 report indicates that since 1976, annual average global temperatures have been warmer than the long-term average (Blunden and Arndt 2013). Average global surface temperatures in 2012 were among the top ten warmest years on record with the largest average temperature differences in the United States, Canada, southern Europe, western Russia and the Russian Far East (Osborne and Lindsey 2013). Impacts of this change will vary throughout the United States, but some areas will experience air and water temperature increases, alterations in precipitation and increased severe weather events. The distribution and abundance of a plant or animal species is often dictated by temperature and precipitation. According to the (U.S. Environmental Protection Agency 2013), as temperatures continue to increase, the ranges of many species are expanding into northern latitudes and higher altitudes. Species adapted to cold climates may struggle to adjust to changing climate conditions (*e.g.*, less snowfall, range expansions of other species).

APHIS recognizes that climate change is an ongoing concern and may result in changes in the range and abundance of numerous species. Climate change may also impact agricultural practices. The combination of these two factors over time may lead to changes in the scope and nature of wildlife-human conflicts in Montana. Because these types of changes are an ongoing process, this EA has developed a dynamic system including mitigations and standard operating procedures (SOPs) that allow the agencies to monitor for and adjust to impacts of ongoing changes in the affected environment. WS-Montana would monitor activities conducted under this analysis in context of the issues analyzed in detail to determine if the need for action and associated impacts remain within parameters established and analyzed in this EA. WS-Montana would supplement the analysis and/or modify program actions in accordance with applicable local, State and federal regulations including the NEPA if substantive changes in the potential environmental effects of program actions warranting revised analysis are identified. Coordination with agencies that have management authority for the long-term wellbeing of native wildlife populations and review of available data on wildlife population size and population trends enables the program to check for adverse cumulative impacts on wildlife populations, including actions by WS-Montana that could jeopardize the long-term viability of WS-Montana actions on wildlife populations. Monitoring would include review of federally-listed T/E species and consultation with the USFWS, as appropriate. Implementation of conservation measures related to avoidance and protection would be anticipated to result from consultation, as necessary, and therefore, reduce or avoid adverse impacts to T/E species and their designated critical habitats.

As with any changes in need for action, WS-Montana would supplement the analysis and/or modify program actions in accordance with applicable local, state and federal regulations including the NEPA, as needed, to address substantive changes in wildlife populations and associated impacts of the PDM program. In this way, we believe the proposed action accounts for and is responsive to ongoing changes in the cumulative impacts of actions conducted in Montana in accordance with the NEPA.

The CEQ has advised federal agencies to consider whether analysis of the direct and indirect greenhouse gas (GHG) emissions from their proposed actions may provide meaningful information to decision makers and the public (Council on Environmental Quality 2014). Based on their review of the available science, CEQ advised agencies that if a proposed action would be reasonably anticipated to cause direct emissions of 25,000 metric tons or more of CO2-equivalent GHG emissions on an annual basis the agencies should consider that a quantitative and qualitative assessment may be meaningful to decision makers and the public (Council on Environmental Quality 2014). APHIS has assessed the potential GHG impacts from the national APHIS-WS program and current and proposed actions in context of this guidance.

The average home produces 9.26 metric tons (MTs) of carbon dioxide equivalents (CDEs; includes CO2, NOx, CO and SOx) annually (U.S. Environmental Protection Agency 2017). Nationwide, APHIS-WS has 170 district and State Offices and this includes district offices (as of 2013) with only one staff member. Using the average home data from U.S. Environmental Protection Agency (2017), we estimate that APHIS-WS produces approximately 1,574 MT of CDEs annually.

Each State Office would likely produce fewer CDEs annually than the average home because little electricity is used at night and on weekends, so this estimate is likely to be conservative.

APHIS-WS vehicles are used for a multitude of wildlife management projects, including current Montana PDM Program activities. APHIS-WS cannot predict the fuel efficiency of each all-terrain vehicle (ATV) used in the field nor can it predict how often an ATV would be used. However, if a conservative estimate of 20 miles per gallon is used and consideration is given to total mileage being substantially less than the mileage calculated for normal vehicular use, the effects of ATVs on air quality would be negligible. APHIS-WS also cannot predict the fuel efficiency of each vehicle in the national program. The Federal Highway Administration (Federal Highway Administration 2017) estimated average fuel consumption per light duty vehicle at 475 gallons per year in 2015. APHIS-WS owned or leased 1,665 vehicles in 2013. The U.S. Environmental Protection Agency (2017) uses 0.989 as the ratio of CDEs to total greenhouse gas emissions for passenger vehicles, and the EPA and United States Department of Transportation use the conversion factor of 8,887 grams of CO2 per gallon of gasoline (75 Fed. Reg. 88, 25330). Using these data, vehicle use by all APHIS-WS programs nationwide might contribute approximately 7,109 metric tons (MT) of CDEs each year.

Nationwide, APHIS-WS either owns or leases ten different types of helicopters; their average fuel consumption is 24.88 gallons per hour. Helicopters with this average fuel consumption emit approximately 0.24 MT/hour of CO2 emissions (Conklin and de Decker Associates 2017). APHIS-WS also owns or leases six different types of fixed wing aircraft. Average CO2 emissions from these types of aircraft is 0.11MT/hour (Conklin and de Decker Associates 2017). Nationwide, APHIS-WS flew 10,426 hours (helicopter and fixed wing combined) of agency-owned aircraft in FY 2013 and flew an additional 4,225 hours under contract aircraft. If all 14,651 flight hours were attributed to fixed-wing planes, the estimated CO2 emissions would be 1,612 MT/year. If all flight hours were attributed to helicopters, the estimated CO2 emissions would be 3,516 MT/year.

Combining vehicle, aircraft, and office use for FY 2013, the range of CDEs produced by APHIS-WS is estimated to be between 10,295 and 12,199 MT per year, which is well below the CEQ's suggested reference point of 25,000 MT/year (Council on Environmental Quality 2014). These are cumulative data for APHIS-WS nationwide. WS-Montana produces only a small proportion of these emissions, and the WS-Montana PDM activities analyzed in this EA produce an even smaller portion.

WS understands that climate change is an important issue. The WS program will continue to participate in ongoing federal efforts to reduce greenhouse gas emissions associated with program activities including compliance with Executive Order 1369 – planning for federal sustainability in the next decade.

Given the information above, none of the alternatives considered is anticipated to result in substantial changes that would impact national APHIS-WS greenhouse gas emissions. WS-Montana PDM activities under the proposed action would have a negligible effect on atmospheric conditions, including the global climate. Therefore this issue will not be considered for comparative analysis.

3.4 How will Alternatives be Assessed Where WS-Montana Activities are Modified or Absent?

Alternative 1 involves continuing the current WS-Montana IPDM activities/proposed action as described in Sections 2.3.1 and Appendix A. Alternatives 2 through 5 modify the levels of WS-Montana involvement in IPDM activities in Montana to differing degrees. A summary of the issues by alternative is presented in Table 3.21 (Section 3.13).

An important part of comparing the environmental impacts and risks to human health and safety of the alternatives is understanding what IPDM may be implemented when WS-Montana has limited or reduced abilities to respond to requests for assistance with a full array of legally available methods applied using the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b). This section provides information on who can and does implement IPDM, and how those activities are likely to compare with WS-Montana's proposed action, its impacts and risks. Additional information on IPDM work conducted by others is available in Sections 2.3.1.10 and 3.4.

3.4.1 What Other Entities Could Respond if WS-Montana IPDM Activities are Restricted or Absent?

Multiple agencies, other entities, and individuals can conduct IPDM activities (Sections 2.3.1.10 and 3.4):

- MFWP can either conduct IPDM directly for game animals or issue a permit for others to take game animals for reducing damage outside of regular game seasons, all of which are reported to MFWP;
- MDOL can issue permits for aerial shooting of coyotes and red fox to private or commercial entities, with each permit issued for specific circumstances and time periods, and reporting of take required;

- Landowners or authorized agents may take predators causing damage or risks on private land in accordance with state law (Section 2.4.4.1), with MFWP requirement for reporting take dependent on species taken. For example, no reporting is necessary for take of coyotes; and MCA §87-6-106 allows black bears, grizzly bears, and mountain lions attacking livestock or a person to be lethally taken without a permit and their take must be reported within 72 hours to MFWP. While this state law will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (see 40 CFR 31734, July 28, 1975) supersede this state law. The extent to which landowners may enlist authorized agents is governed by state law and invariably modifications to existing state laws are considered each legislative session. For example, in the 2019 session serious consideration was given to House Bill 279 that would have allowed trappers to be reimbursed for up to $500 for each wolf killed. This bill was considered by many to be a bounty and was backed by some livestock groups as a means to manage wolves causing damage to livestock. Ultimately the bill died in process due to lack of support and the perception of bounties as an ineffective wildlife management tool (Section 2.5.5).
- WS-Montana may provide IPDM services when requested on any land class, either directly or as an agent of MFWP or MDOL, including technical advice on lethal and non-lethal methods and implementation of lethal methods. WS-Montana keeps detailed records of take in the MIS database.

3.4.2 How do IPDM Activities Conducted by All Entities, Including WS-Montana, Compare with each other?

As discussed in Section 3.9, the proficiency and experience of the person using lethal and non-lethal take methods are critical for ensuring effectiveness, selectivity, and humaneness. Individual landowners may hire or request other individuals, including pest control companies, to address the damage problem, or address the problems themselves. Individual landowners are less likely to have the proficiency, experience, or skill for using traps, snares, harassment equipment, or firearms for lethal take of predators in a humane, selective, and/or effective manner. Landowners and their agents may use traps, snares, and firearms in a manner inconsistent with best practice standards for humaneness and effectiveness. They would also not be required to use the same decision process that WS-Montana uses (APHIS-WS Decision Process; Section 2.3.1.2).

3.4.2.1 Small Predators

Many commercial pest control companies focus on small predators such as raccoons and skunks. A small number of pest control companies include badgers, foxes, and bobcats in their services when these are present. Take of furbearers in legal trapping season is typically far greater than WS-Montana average (Table 3.1). However, furbearer trapping is generally not directed at addressing small predator damage and risk.

3.4.2.2 Grizzly Bears, Black Bears, and Mountain Lions

MCA §87-6-106 allows black bears, grizzly bears, and mountain lions attacking livestock or a person to be lethally taken without a permit. Their take must be reported within 72 hours to MFWP. While this state law will regulate grizzly bear take once the species is delisted, current federal regulations regarding grizzly bear take (see 40 CFR 31734, July 28, 1975) supersede this state law. Individuals who request assistance from MFWP may get direct assistance from the agency, MFWP may refer the request to an MFWP agent, such as WS-Montana, or the landowner may designate their own agent, or they may take the bear or mountain lion themselves. The average take of black bears and mountain lions reported to MFWP and the average WS-Montana take are similar (Table 3.1). Therefore, if WS-Montana was not available to provide for lethal take of depredating or threatening black bears or mountain lions, MFWP may increase their responses and landowners might begin to take lethal action themselves or authorize others as their agents. MFWP take of grizzly bears is greater than WS-Montana's take (Table 3.1). Typically, WS-Montana transfers custody to MFWP when WS-Montana is requested to capture a grizzly bear suspected of depredating livestock. MFWP and the USFWS then work together to determine whether that bear is relocated or euthanized. In rare circumstances, WS-Montana is requested to take a grizzly bear. This typically occurs when a depredating grizzly bear is in a remote location that MFWP cannot easily access, and WS-Montana personnel can access the site either by helicopter or on horse-back.

3.4.2.3 Coyotes

Coyote take reported by licensed fur trappers accounts for 2.7 times the number of coyotes taken by WS-Montana in response to requests for IPDM (Table 3.1); coyotes taken under MDOL permits for aerial operations account for an additional 508 coyotes annually (Table 3.1). Aerial operators permitted by MDOL are restricted to flying only under the purpose, location, and terms of the permit, with written and reported authorization by all landowners over which they may fly. Additionally, landowners can take coyotes themselves or have someone else designated as their agent remove them, for example commercial pest control companies. Coyotes taken as a predatory animal (MCA §87-2-101) are not required to be reported.

In Montana, M-44 devices (sodium cyanide) may be used by licensed pesticide applicators operating under a permit from MDA. The label for M-44 use by private individuals differs from the label used by WS applicators. In 2019, 6 private M-44 applicators are licensed through MDA. Approximately the same number of WS-Montana field specialists, 5 individuals, regularly use M-44s. M-44s are not commonly used by WS-Montana staff, with associated take comprising approximately 7% of the total WS-Montana annual coyote take from FY2013- FY2017 (Table 2.1, Table E.1). Although M-44 devices may be authorized on some public lands, only 1.4% of take with M-44 devices for FY2013-FY 2017 occurred on public land, more specifically BLM and state lands. WS-Montana conducted 92.9% of its coyote removal on private land (Table 2.2). If WS-Montana is restricted or prohibited from taking coyotes lethally under alternatives 2 through 5, it is assumed that producers would request more MDOL permits for aerial operations, and/or landowners would begin or increase lethal take themselves or by requesting assistance from private trappers, commercial pest control companies, or other individuals.

Table 3.1. **Average annual known lethal predator take in Montana by source, FY 2013- FY 2017.**

Common Name	Non-Hunting/Trapping Take (MFWP and/or USFWS)[1]	Take Reported to MDOL (aerial)[2]	Hunting/ Trapping Take Reported to MFWP[3]	**WS-Montana Take**
Coyote	-	507.8	17,533	6,376
Red fox	-	3.4	1,884	146
Raven	23	-	-	121
Gray wolf	-	-	227	52.4
Mountain lion	14.4	-	491	14.4
Striped skunk	-	-	1,380	12.2
Black bear	16	-	1,469	9.8
Badger	-	-	887	8.6
Raccoon	-	-	4,175	5
Grizzly bear	8.6	-	-	0.8
Feral dog[4]	-	-	-	0.6
Feral cat[4]	-	-	-	0.4
Bobcat	-	-	1,375	0.4
Feral Swine	-	-	-	-

[1] Non-hunting trapping take indicates management removals by MFWP for black bear and mountain lion (B. Inman, personal communication, 8/20/2018), USFWS authorized management removals for grizzly bear (C. Costello, personal communication, 8/15/2018 and https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-science_center_objects=4#qt-science_center_objects), and USFWS MBTA permitted take for private entities for ravens (K. Gonzales, personal communication, 8/22/2018).

[2] Take reported in this column in non-WS aerial take permitted by MDOL (S. Boudreau, personal communication, 8/14/2018).

[3] Hunting or trapping take is either from MFWP furbearer reports (2013-2016 https://myfwp.mt.gov/fwpPub/harvestReports) or from direct communications with MFWP for black bears and mountain lions and 2017 furbearer report (B. Inman personal communications, 8/20/2018 and 4/12/2019).

[4] Cats and dogs are managed by local authorities and take cannot be estimated.

3.4.2.4 Summary

Several government and private entities conduct IPDM in Montana. These include MFWP, MDOL, WS-Montana, commercial pest control companies, and private individuals. While overlap among these in terms of IPDM methods and equipment sometimes occurs, their timing, location, experience and proficiency can be expected to vary.

3.4.3 Benefits of WS-Montana IPDM Activities

Benefits from WS-Montana's IPDM work that may not occur when other entities are used include (a) WS-Montana employees are highly trained and dedicated professionals that adhere to the APHIS-WS directives (Section 2.4) to minimize adverse effects on the environment and reduce risks to humans, (b) WS-Montana records its activities through the MIS database so that information can be readily available for environmental analysis, partner agency use, periodic summaries and public scrutiny, and (c) WS-Montana's use of the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) ensures that the most effective, selective, and humane IPDM strategies are used in accordance with federal, state, and local laws (Section 1.10.3, Section 2.4).

As a federal agency responsible for compliance with NEPA, APHIS-WS documents and analyzes its activities and involves other agencies, Tribes, and the public to ensure that it makes informed and transparent decisions about IPDM. It is under the umbrella of NEPA that all of APHIS-WS's IPDM activities are reviewed for their effects on the human environment. The effects of IPDM methods on humans and the environment, results of ESA Section 7 consultations, and Tribal government concerns are among the physical, biological, and sociocultural issues included in a NEPA document.

Effects of private actions are not generally reportable to the public unless the action is taken under a permit or is required to be reported by state law. Because of the federal NEPA process requiring the agency to evaluate its activities on the human environment, and because APHIS-WS policy is to allow the public to comment on EAs before decisions are made, special interest groups and interested citizens are able to focus their attention on federal agency decision-making where it would be more difficult or impossible to discover the actions, assess and understand the effects, and participate in decision-making of other entities.

3.5 What are the Impacts on Predator Species Populations?

This section includes the direct and cumulative analyses of potential impacts on populations of individual predator species in Montana. These analyses include all take (lethal removal) by WS-Montana, and all other take reported to state management agencies including hunter and trapper harvest and some take by private citizens for depredation or health and safety reasons.

3.5.1 What Methodologies and Assumptions Were Used for Population Analyses?

Estimating wildlife population sizes over large areas can be extremely difficult, labor intensive, and expensive. State and federal wildlife management agencies have limited resources to conduct wildlife population surveys and monitor trends.

States may assess the status of wildlife populations by evaluating sex ratio and age distribution data periodically. Indices of relative abundance or data on catch-per-unit effort from hunter surveys also serve as relative measures of population size and status. This EA uses the best available information from jurisdictional agencies and peer-reviewed literature to provide estimates of wildlife population size and status.

The magnitude of the potential impacts on target species is quantified to the greatest extent possible for each of the alternatives considered, based upon population estimates from the literature or MFWP or USFWS data. Tables 3.2 through 3.18 provide an overview of the status of the statewide populations and estimated populations for the predator species included in this EA. Population demographic information is included in the description for each species, and information on sources of mortality for each species is provided in the tables incorporated into the analysis for each species (Tables 3.2 through 3.18).

As the state wildlife regulatory agency, MFWP provides population estimates or indices of population size for black bears, mountain lions, and wolves. Population estimates for grizzly bears are determined based on recovery area, which may span several states, and are provided by either MFWP or USFWS annually. For the other predator species in this EA, MFWP does not estimate abundance. In order to estimate population size for these species, conservative estimates are derived from the best available density estimates reported in the literature, with preference given to publications and studies of Montana populations or states with similar habitat. Density estimates from different studies may not always be comparative because they are conducted at different times of the year, may be estimated for adults, breeding adults, young, or all age classes. Studies also identify their assumptions or limitations of their density estimates. The lowest estimate is assumed to be the minimum population. Habitat suitability indices, localized density fluctuations, and immigration/emigration are not factored into these calculations, nor is density in Montana based on quantity of habitat, as this information is not available. All population estimates are considered to be conservative, as we have used the lowest population estimate among the ranges of those available in the literature.

As discussed in Section 1.11.2.9, approximately 65% of the state of Montana is private land. Nearly 93% of WS-Montana lethal take of predators between FY2013 and FY2017 occurred on private land. Furthermore, WS-Montana actively works on only a small portion of all the available properties that have signed WIDs at any given time. Of those properties being actively worked, IPDM activities are conducted on only a fraction of the total area which the property encompasses. Thus, the potential impacts from WS-Montana's IPDM activities on wildlife populations are only in a small portion of the state and for a limited duration.

In order to analyze the level of effects of WS-Montana on the individual species' populations, available take data is presented annually by species for FY2013 through FY2017 (Tables 3.2 through 3.18). WS-Montana's intentional take is used to analyze the direct effects on species populations. All sources of WS-Montana take of predator species are combined with all known sources of non-WS take in Montana to represent the cumulative take. Cumulative take may include measures of:

- WS-Montana intentional take of a predator species;
- WS-Montana unintentional take of a predator species;
- MFWP management removal (intentional lethal removal conducted by MFWP);
- Legal harvest regulated by MFWP;
- Private entities take of ravens through MBTA depredation permits issued by USFWS;
- Aerial take of coyotes and red fox by non-WS-Montana entities, as permitted by MDOL;
- Other allowable take for damage or threats to human health or safety reported to MFWP per MCA §87-6-106;

- Other known mortality sources, such as vehicle collisions or poaching.

To assess whether cumulative take is negatively effecting a predator's population estimate, cumulative take is compared to the maximum sustainable yield (harvest), the amount of mortality from all known sources that can be maintained in perpetuity (Botsford 2016). In this case, the proportion of the estimated species population taken by all sources in the year with the highest take between FY2013- FY2017 is compared to the lowest maximum sustainable harvest level from the literature. Because the cumulative take is compared to the conservative statewide population estimate for each species, the cumulative impact analyses in this section adjusts for imperfect data and err in favor of overestimating potential impacts on predator populations.

Additionally, similar calculations are made to determine the projected cumulative impacts under the projected WS annual maximum take scenario. The WS-Montana annual maximum take is represented as the highest projected take in a given year under the current action (Alternative 1) adjusted for potential increases in the level of assistance requested (Appendix E). The projected annual cumulative take provides a liberal estimate of the highest proportion of the estimated species population that could be taken by all sources under the projected WS annual maximum take scenario. The proportion is then compared to the lowest maximum sustainable harvest level from the literature.

Under no circumstances should the projected WS annual maximum take be interpreted as the target number of animals WS-Montana seeks to remove, nor does APHIS-WS have a policy of ever taking the maximum sustainable harvest proportion of the population for any species, with the exception of non-native invasive species, such as feral swine (Section 3.5.15).

As explained in detail in Chapters 1 and 2, APHIS-WS personnel work to resolve conflicts with wildlife and facilitating human-predator coexistence while minimizing risk of adverse impacts on a case-by-case basis. To this end, efforts focus on removing specific depredating individuals or local groups of predators. Furthermore, APHIS-WS policy gives preference to non-lethal methods where practical and effective (WS Directive 2.101; Section 2.4).

Cumulative impacts rely on data that can be collected. Unknown and unreported (Section 2.3.1.10) mortality can't be calculated, however WS-Montana has used maximum take projections and conservative population estimates to consider potential impacts. These analyses do not incorporate take from IPDM activities conducted in adjacent states. Wildlife management authority resides with the states. WS-Montana's analysis is on assisting the State of Montana and other entities that are within Montana and according to applicable Montana statues and rules. The information compiled in the analysis of this EA is sufficient to address the impacts associated with the alternatives for WS-Montana involvement in IPDM in Montana.

3.5.2 What are the Direct and Cumulative Impacts on Coyote Populations?

3.5.2.1 Coyote Life History Information

Coyotes (*Canis latrans*) were once found only in western States, but have expanded their range in recent history to much of North America (Gese and Terletzky 2009) as a result of changes in habitat, loss of wolves, and possible introductions into other parts of the country where they were previously not found (Bekoff and Wells 1982, Voigt and Berg 1999). Coyotes are widely distributed and common in Montana (Pyrah 1984, Arjo and Peltscher 2004) with 15,000-20,000 harvested annually (MFWP furbearer reports (2013-2016 https://myfwp.mt.gov/fwpPub/harvestReports) and from direct communications with MFWP for 2017 furbearer report (B. Inman personal communications, 8/20/2018 and 4/12/2019). Coyotes are ecological generalists; they can adapt to many different environments and diets. Even among ecological generalists, many wildlife biologists characterize coyotes as having a unique resilience to change. In fact, the habitat changes that have occurred over the last two hundred years have generally favored the species. The coyote's ability to adapt to changing environmental conditions and its opportunistic nature has resulted in its increased abundance and wider distribution during the past several decades (Mastro 2011).

The coyote resembles a medium-sized dog, with adults weighing an average of 22 to 30 pounds. In the wild, they typically feed on small mammals, birds, reptiles, fruits, seeds, and carrion. In urban and suburban areas, they also feed on rabbits and pets, including cats. Coyotes can also feed on larger mammals, such as deer, antelope, and livestock, and scavenge when opportunities arise.

Coyotes are adaptable to a wide variety of conditions, including those created by humans and their resource-rich subsidized environments (Section 3.8). Coyotes are highly mobile animals with home ranges that may vary seasonally and with the sex and age of the animal (Pyrah 1984, Servin and Huxley 1995, Gese 2001). Alpha pairs have stable territories that they defend (Gese 1998, Wallach et al. 2009), while single transient coyotes may travel long distances until they become established within a territory. They normally hunt during the evening and night (except for those habituated to human presence), singly or in pairs, but in late summer or early fall may hunt with the family group (Section 1.12.4.2).

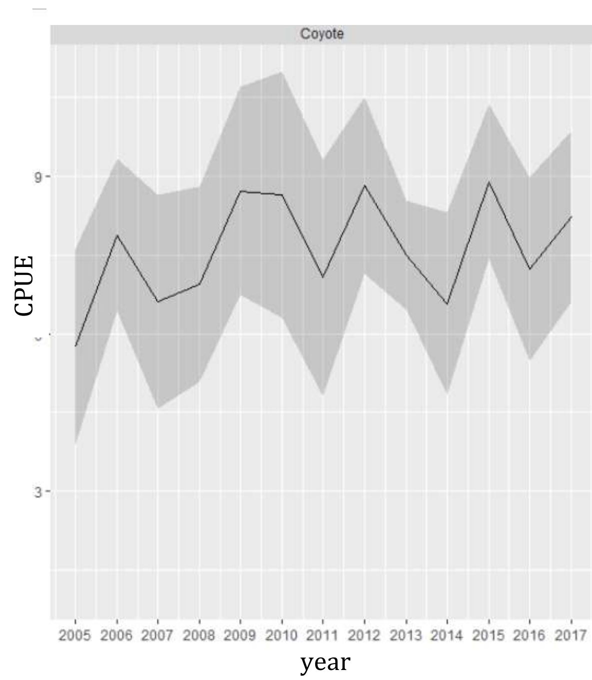
Coyotes annually produce one litter of four to eight pups in April and May (Knowlton et al. 1999). The young disperse at about six to nine months (Bekoff and Wells 1980). Only the alpha pair breed and only 10% of the young from a given pair need to survive and reproduce to replace the pair. The remaining 90% of any subdominant animals may either stay with the breeding pair to assist with raising pups or, more likely disperse and often die before establishment in a new territory (Knowlton et al. 1999).

Coyote spatial organization is complex and can vary between study sites and with seasonal breeding activities (Messier and Barrette 1982, Windberg and Knowlton 1988). Each occupied coyote territory may have several non-breeding helpers at the den during whelping (Bekoff and Wells 1982, Allen et al. 1987). Messier and Barrette (1982) reported that from November through April, 35% of the coyotes were in groups of three to five animals and Gese (1998) reported that coyote groups of two, three, four, and five comprised 40%, 37%, 10% and 6% of the resident population, respectively. The presence of unusual food concentrations and nonbreeding helpers at the den can influence coyote densities and complicate any effort to estimate abundance (Danner and Smith 1980). To that end, a positive relationship was established between coyote densities in mid-late winter and the availability of livestock carcasses (Roy and Dorrance 1985).

3.5.2.2 Coyote Population Information

Coyotes are classified by MCA §87-2-101 and 81-7-101 as a predatory animal in Montana, and as such may be taken year-round for any reason without a requirement to report take. MFWP does not track or attempt to estimate coyote population levels or densities. MFWP coyote population monitoring activities are based on voluntary trapper harvest survey data with catch per unit effort (CPUE) considered to be an indicator of relative population trend (Giddings 2014). MFWP indicates that reported take and CPUE suggests a relatively stable to increasing population (Figure 3.1, personal communications, David Messmer, MFWP, 7/25/2019).

Figure 3.1. Catch per unit effort for coyotes in Montana



Coyote population densities vary depending on the time of year, food abundance, and habitat. Many authors have estimated coyote populations throughout the west and elsewhere reporting densities that ranged from 0.4/mi^2 to 11.9/mi^2 (Knowlton 1972, Pyrah 1984, McClure et al. 1996, Fedriani et al. 2001). The lowest reported densities (0.4/mi^2) are for spring populations in north-central Montana in the Missouri River Breaks (Pyrah 1984), when the annual population cycle is lowest, after dispersal of young, and most or all natural and anthropogenic mortality has occurred; this is often referred to as the pre-whelping density. Those same coyote populations numbered 2.5-times higher (1.0/mi^2) in the summer, post-whelping (Pyrah 1984). Similar numbers were reported in Kansas by Gier (1968), where pre-whelping and post-whelping densities were estimated at 0.7/mi^2 and 2.0/mi^2, respectively. This represents a 2.9-fold increase. Berger et al. (2008) reported coyote densities of 0.70 coyotes/mi^2 in areas of Wyoming with wolves and 1.1 coyote/mi^2 in areas without wolves with differences in density primarily attributable to differences in the transient portion of the population. WS-Montana observes similar differences in densities of coyotes with fewer coyotes observed and less damage occurring in the western half of the state, which is occupied by wolves, than the eastern half of the state, which does not have a resident wolf population. WS-Montana observations suggest that coyote densities vary dramatically across the state with the highest densities occurring in northeastern Montana from the Rocky Mountain Front to the eastern boundary of the state. Coyote densities will be estimated conservatively based on the pre-whelping density estimate of 0.4/mi^2 from (Pyrah 1984). Although this is not the most recent estimate of coyote densities and it is from an area without wolves, it is a density estimate from Montana and the lowest density of coyotes in the literature. Therefore, a population estimate based on this density will be extremely conservative estimate. Montana is about 147,000 mi^2 in size, with much of the state comprised of suitable coyote habitat. The population estimate of 58,800 animals is used to evaluate the impacts of WS-Montana actions.

A population model developed by Pitt et al. (2001) assessed the impact of removing a set proportion of the coyote population in one year and then allowing the population to recover (referred to as "pulse removal"). In the model, all populations recovered within 1 year when <60% of the population was removed. The population recovered within 5 years when 60-90% of the population was removed. The authors stated that actual coyote populations would recover even more quickly than the model indicated, because the model made several conservative assumptions: (1) coyote territories were retained even at low densities, (2) animals would not move out of their territories to mate, (3) no animals moved in from surrounding areas (no immigration), and (4) natural mortality rates were not reduced at low population densities. Assumptions like these are generally necessary in order to simplify population models, but in this case, each assumption removes a biological function which would serve to help the population recover more quickly.

Pitt et al. (2001) also evaluated the impact of removing a set proportion of the population every year for 50 years ("sustained removal"). When the removal rate was <60% of the population, the population size was the same as for an unexploited population. However, a shift in population structure was noted. For example, the population with 50% removal had fewer transient animals, a younger age structure, and higher reproduction. Sustained removal rates of >70% of the population resulted in removal of the entire population after 7 years in the model, but the authors acknowledged that annual removal of 70% of the population would become increasingly difficult at low densities.

Because of the model limitations described above, natural populations are probably able to withstand greater levels of sustained removal than their model indicated as well. An earlier model developed by Connolly and Longhurst (1975b), and revisited by Connolly (1995), indicated that coyote populations could withstand an annual removal of up to 70% of their numbers and still maintain a viable population. These conclusions are supported by Pitt et al. (2001) as well. For this EA, we will use the lowest reported long-term sustainable harvest rate (60%) as a conservative estimate. This means that the coyote population will not be negatively affected if less than 60% of the population is removed annually, and that any rate below 60% can be continued in perpetuity with no deleterious effect. Harvest rates above 70% would also not affect the statewide population, as long as they are not continued long-term.

In a study by Gese (2005), approximately 44% - 61% and 51% - 75% of an estimated coyote population was removed from a 131 mi^2 project area using aerial shooting and trapping, respectively. Removals resulted in substantial reductions in coyote pack size and an associated decrease in density, but both pack size and density rebounded to pre-removal levels within eight months. Radio collar data and shifts in age structure support the hypothesis that the coyotes colonizing the area after control were non-territorial individuals, which included yearlings from adjacent denning pairs of coyotes. Mean litter size did not differ substantially after the first year of winter and spring coyote removals, but increased the second year (see Section 3.3.4 for a discussion of compensatory reproduction in coyotes). Average litter size was correlated to the density of coyotes entering the breeding season (Gese 2005). The seasonality of the coyote removal in the

Gese (2005) study was similar to that which occurs in the Montana program, but the proportion of the coyote population removed in the Gese (2005) study was higher than typically occurs in Montana (Section 1.5.2.3.1 below).

3.5.2.3 Coyote Population Impact Analysis

3.5.2.3.1 WS-Montana Direct Effects on Coyotes

During FY2013 – FY2017, coyotes were responsible for 36% of the livestock losses recorded by WS-Montana, and 49% of the value of all losses due to predators. The value of losses from coyotes averaged $605,139 per year (Table 1.6). They are therefore a major focus of WS-Montana IPDM efforts, and they make up the largest percentage of the WS-Montana predator take (94.5% of the annual average from FY2013 - FY2017). The resources that WS-Montana protects from coyote depredation include livestock (primarily lambs and calves), property, and human health and safety.

WS-Montana take primarily occurs in more human-influenced environments which is where the majority of conflicts with livestock occur and where coyotes have been shown to have higher densities, as discussed above (Fedriani et al. 2001). Moreover, coyote populations in agricultural areas, where most coyotes are taken by WS-Montana, have been shown to be better able to withstand harsh weather and fluctuations in prey abundance than coyote populations in more forested areas (Todd 1985). In fact, "farm carrion" was the most important winter food source in both agricultural and forested areas (Todd 1985). This information further underscores how conservative our analysis is.

The greatest number of requests for assistance with IPDM made to WS-Montana were related to coyotes. In response, WS-Montana has intentionally taken an average of 6,387 coyotes per year statewide during FY2013 - FY2017 (Table 3.2). These numbers represent 8.2% to 12.2% of the estimated coyote population in Montana. WS-Montana did not unintentionally remove any coyotes during the analysis period (Table 3.2).

Included in the reported intentional WS-Montana take numbers is the take of coyotes in dens (Table 3.2), estimated at four individuals per den. This estimate is based on average den occupancy, with a 50% likelihood of dens containing one adult with six pups per litter (Pyrah 1984, Gese et al. 1989, Wapenaar et al. 2012) for a total of seven coyotes. The other 50% of the time, an estimate of one coyote per den is used to account for scenarios where there is one lone adult, a den with less than six pups due to juvenile mortality or dispersal after maturation, and vacant dens.

Over 64% of the coyotes were taken from aerial shooting, 13% are taken by traps and snares (not including cage and culvert traps), 15% were taken by ground shooting and calling and shooting, 7% were taken by M-44s (sodium cyanide), and 1% were taken by use of sodium nitrate gas cartridges in dens (Table 2.1; Table E.1). Most coyotes (93%) are taken by WS-Montana on private land (Table 2.2) for livestock protection.

Coyote take by WS-Montana often varies considerably from year to year, and we anticipate such variation in future years. Under Alternative 1, we anticipate maximum annual take of coyotes by WS-Montana would be less than 10,000 annually. This take represents 17% of the estimated population[2], which studies estimate can withstand annual take of at least 60%. Based on this information, IPDM by WS-Montana would have minor short-term impacts on coyotes locally, and no impact on the overall coyote population in Montana. WS-Montana coyote take may cause a temporary decrease in localized populations where more frequent IPDM is performed, but other coyotes will re-occupy these areas; thus, there will be no long-term effects in these locations, and no effect on the statewide population. Short-term decreases in local populations are often the goal of IPDM, as discussed previously.

Annual mortality in coyote populations is known to range from 19-100% with 40-60% mortality most common. In an EIS on mammalian PDM (U.S. Fish and Wildlife Service 1979), studies of coyote survival rates were analyzed and the following conclusions were made:

- Typical annual survival rates are only 45-65% for adult coyotes.
- High mortality rates have also been shown in four telemetry studies involving 437 coyotes that were older than 5 months of age; 47% of the marked animals are known to have died.
- Mortality rates even among "unexploited" coyote populations were reported to be between 38-56%.
- Most coyote populations, even those that are not subjected to control activities, are dynamic.
- In studies, where reported coyote mortality was investigated, only 14 of 326 recorded mortalities were due to WS activities.

Dispersal of "surplus" young coyotes is the main factor that keeps coyote populations distributed throughout their habitat. Such dispersal of subdominant animals removes surplus animals from higher density areas and repopulates areas where population reductions have occurred. Two studies (Connolly et al. 1976, Gese and Grothe 1995) investigated the predatory behavior and social hierarchy of coyotes, and determined that the more dominant (alpha) animals were the ones that initiated and killed most of the prey items. Connolly and O'Gara (1987) concluded that the inclination of individuals to attack seemed related to their age and relationships with conspecifics. The coyotes that attacked sheep most frequently were 2-year old males and females paired with these males. Gese and Grothe (1995) found that the dominant pair was involved in the vast majority of predation attempts. The alpha male was the main aggressor in all successful kills, even when the other family members were present. Thus, it would appear that removal of local established territorial coyotes actually removes the individuals that are most likely to kill livestock and can result in the immigration of young coyotes that are less likely to kill livestock.

Conner (1995) suggested that some WS employees are not very successful in removing dominant territorial coyotes. However, the study involved coyotes which had already been captured once for radio telemetry purposes and were thus substantially more difficult to catch (G. E. Connolly 1997, pers. comm.). In a review of the study and its

[2] The coyote population in Montana was estimated to be 58,800 (Section 1.5.2.2 above). This estimate will be used to determine impacts (Table 3.2).

conclusions, R. Timm, the Superintendent and Extension Wildlife Specialist at the Hopland Research and Extension Center where Conner's research took place, disagreed with Conner's conclusions, citing "noise" (*i.e.*, confounding factors or unaccounted variables) in the data, and expressed the opinion that WS efforts "usually reduced the amount of coyote-caused loss which we would have otherwise experienced on our research sheep flock" (Pers. Comm. to C. Coolahan, State Director, WS-Colorado, April 15, 1996). Based on the studies' shortcomings described above, WS-Montana disagrees with the assertion that experienced WS personnel are not proficient at removing dominant pairs.

In a study in New Mexico, Windberg et al. (1997) found no statistically significant difference between territorial and transient coyotes in the proportion of each type that consumed Angora goats. They concluded that management measures to protect livestock during periods of exposure of highly vulnerable kid goats or lambs may be best directed at local coyote populations rather than at particular cohorts or individuals. Their study supports the belief that removal of coyotes from a local population without regard for age or territoriality is advisable in many situations and would not result in a worsening of predation problems for more vulnerable types of livestock such as Angora goats. Wagner and Conover (1999) found that total lamb losses declined 25% on grazing allotments in which coyotes were removed during winter aerial PDM 5-6 months ahead of summer sheep grazing, whereas total lamb losses only declined 6% on allotments without aerial PDM. Confirmed losses from coyotes declined by 7% on allotments with aerial PDM, but increased 35% on allotments receiving no aerial PDM (Wagner and Conover 1999). This study provides evidence that coyote removal even several months ahead of the arrival of livestock can be effective in reducing predation losses, and that such removal does not actually result in increased losses, as has been asserted by some commenters. These data support the use of preventive IPDM to prevent losses before they occur.

3.5.2.3.2 Indirect Impacts

Indirect impacts of WS-Montana IPDM on coyotes include the possibility of increased dispersal and increased fecundity, which may lead to a younger age structure in local coyote populations (Jackson 2014). Such indirect impacts from WS-Montana IPDM would be limited to those areas where WS-Montana conducts IPDM. Such localized impacts would be temporary and would likely have no impact on statewide populations due to the limited area in which WS-Montana conducts IPDM. These are also natural responses to other environmental factors. WS-Montana has no reason to believe that such changes would result in any negative impact to the statewide coyote population, or any long-term impact to local coyote populations. Under Alternative 1 we anticipate that indirect impacts would be negligibly low, and that there would be no indirect impact on the statewide coyote population.

3.5.2.3.3 Cumulative Mortality on Montana Coyote Populations

Per state law, coyotes may be legally harvested year-round. Furbearer harvest is the largest category of take, and it can be estimated. Coyote removal by private individuals for PDM also occurs and aerial removal by private individuals is permitted by MDOL (Table 3.2). Additional coyote take is likely to occur, but there are no data available to estimate this take, and it is expected to be low compared to all other methods of take. We have included all of the known take which we are aware of that can be estimated or quantified.

Furbearer harvest is estimated in most years by MFWP based on surveys. We used 2012-13 season data for FY2013, and so forth, because these timeframes best match our FYs. Furbearer harvest estimates for the FY2013 – FY2017 timeframe ranged from 15,435 to 20,216 with an annual average of 17,533 coyotes (Table 3.2) representing 30% of the coyote population. These estimates are statistically derived based on voluntary mail surveys of licensed trappers which contain inherent error; however, they are the only data available to estimate harvest. Aerial shooting by private individuals permitted by MDOL removed between 121 and 746 coyotes annually with an average of 508 coyotes per year (Table 3.2).

Using these numbers, cumulative take averaged 24,428 coyotes per year during FY2013 – FY2017, with a high of 27,511 in FY2013. This represents an average harvest of 41.5% of the state's coyote population with a high of 46.8% in FY2013. These numbers are all well below the 60% sustainable harvest threshold.

Given that all sources of take vary annually, the projected maximum annual cumulative take was calculated based on the highest year of take for each source during FY2013 – FY2017 with the projected WS maximum annual take of 10,000 coyotes used for WS-Montana's projected take. This increased the projected maximum annual cumulative take to 30,962 coyotes or 52.7% of the population, which is still below the 60% sustainable harvest threshold.

Even with possible under-reporting of hunter harvest and PDM by other individuals, the coyote population would not be negatively affected unless this additional harvest totaled more than 4,318 coyotes each year, bringing the cumulative total above 35,280 (60% of the estimated population). This level take by other individuals is extremely unlikely, due to the level of effort which would be required. Moreover, occasional years with take above the 60% threshold would also not impact the coyote population, as long as such take levels did not continue long-term.

We also considered the possibility that cumulative coyote take might result in a younger coyote age structure statewide, and that coyote take by WS-Montana might contribute to such an impact. However, the locations where hunters harvest coyotes are generally spatially separated from those areas where WS-Montana conducts IPDM. Most WS-Montana IPDM (Table 2.2) is conducted on private lands.

Under Alternative 1, we do not anticipate any major changes in the amount of cumulative coyote take in Montana. Thus, we anticipate low cumulative impact on local coyote populations in the short-term, and no impact on the overall Montana coyote population (Table 3.2). This is due, at least in part, to the ability of coyotes to rapidly occupy vacant territories where coyotes have been removed (Windberg and Knowlton 1988). Whereas removing coyotes from localized areas at the appropriate time can protect vulnerable livestock, immigration of coyotes from the surrounding area quickly replaces the animals removed (Stoddart 1984). Connolly (1978) further noted that coyotes have survived and even thrived in spite of early 20th century efforts to exterminate them.

Cumulative take of coyotes is also largely limited to human-influenced environments, which have been shown to have higher coyote densities, as discussed above (Fedriani et al. 2001). Thus, the magnitude of cumulative take in Montana is even less likely to impact statewide coyote populations, because it is focused where the populations are highest.

Under Alternative 1, there would be no significant impact on the coyote population. This determination is consistent with the General Accounting Office (1990) assessment that WS's PDM program nationwide has not threatened statewide predator populations, including coyotes, particularly in the western United States where such PDM programs were most prevalent.

Coyote populations are considered to be increasing throughout their range, and they are listed as a species of "least concern" according to the International Union for Conservation of Nature (International Union for Conservation of Nature 2017).

Coyotes taken through a licensed trapper are requested to be reported through voluntary mail surveys.

3.5.2.4 Conclusion: Coyote

Given the stable population trend for coyotes in the state, an annual maximum sustainable harvest level of 60%, cumulative impacts on the coyote population from all causes, including take by WS-Montana, is not adversely impacting the size or sustainability of the coyote population.

Therefore, WS-Montana concludes that the cumulative impact of all recorded coyote mortality in Montana, including intentional and unintentional take by WS-Montana, is not adversely impacting the size or sustainability of the Montana coyote population. In addition, MFWP determined that all available harvest information indicates a stable population trend (Giddings 2014).

Should an increase in requests for assistance with coyote damage result in the projected annual WS maximum take of 10,000 coyotes per year, cumulative impacts on the statewide coyote population would still be expected to remain low relative to the annual maximum sustainable harvest level. Given the low proportion of cumulative take, and even lower WS-Montana take, direct and cumulative impacts from take would not adversely affect the Montana coyote population.

Table 3.2. Population impact analysis of coyote take in Montana, FY 2013- FY 2017.

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional coyote take[1]	6,918	4,745	6,601	7,123	6,166	**6,311**	**7,123**
Estimated WS intentional den take[1]	64	108	80	68	60	**76**	**108**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
Furbearer Harvest[2]	20,131	15,652	16,233	15,435	20,216	**17,533**	**20,216**
Aerial Take by MDOL permittees[3]	398	121	746	687	587	**508**	**746**
Total WS take	6,982	4,853	6,681	7,191	6,226	6,387	**7,191**
Cumulative Take	27,511	20,626	23,660	23,313	27,029	24,428	**27,511**

Estimated Population	58,800	58,800	58,800	58,800	58,800	**58,800**	**58,800**
WS Take % of Pop.	11.9%	8.3%	11.4%	12.2%	10.6%	**10.9%**	**12.2%**
Cumulative Take % of Pop.	46.8%	35.1%	40.2%	39.6%	46.0%	**41.5%**	**46.8%**
Projected WS Maximum Annual Take	10,000 coyotes			17.0% of population			
Projected Maximum Annual Cumulative Take	30,962 coyotes			52.7% of population			

[1] USDA-WS-APHIS Management Information System.
[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).
[3] Other take includes aerial shooting by private individuals permitted by MDOL.

3.5.3 What are the Direct and Cumulative Impacts on Red Fox Populations?

3.5.3.1 Red Fox Life History Information

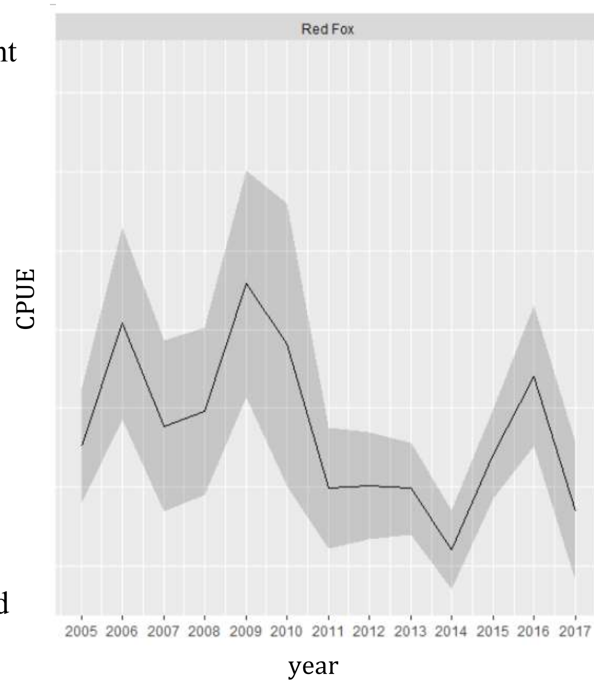
Red fox (*Vulpes vulpes*) are the most common and well-known species in the genus *Vulpes*, and are the most widely distributed nonspecific predators in the world (Voigt 1987). Red fox are found throughout much of North America and are common in varying abundance throughout Montana. Like coyotes, red foxes are ecological generalists, and therefore very adaptable to new environments. The red fox has a high reproductive rate, a dispersal capacity similar to coyotes, and can withstand high mortality within the population (Harris 1979, Voigt and MacDonald 1984, Voigt 1987, Allen and Sargeant 1993)((Phillips and Mech 1970, Andrews et al. 1973, Storm et al. 1976, Pils and Martin 1978). Red fox eat mostly small mammals, birds, insects and mast, but will also take small livestock and poultry. Foxes are regarded as nuisance predators in many regions, preying on wildlife and livestock, especially poultry (Ables 1969, Andrews et al. 1973, Tabel et al. 1974, Tullar Jr et al. 1976, Pils and Martin 1978, Sargeant 1978, Voigt 1987, Allen and Sargeant 1993).

Fox pups are born in dens between March and May, and are weaned at eight to ten weeks. Rowlands and Parkes (1935) and Creed (1960) reported that male red foxes breed in their first year. Storm et al. (1976) stated that 95% of the females (43.6% were less than one year old) bred successfully in populations in Illinois and Iowa. Litter sizes averaged about 4.7 offspring among 13 research studies, with litters up to 17 offspring reported (Storm et al. 1976, Voigt 1987). Ables (1969) and Sheldon (1950) reported that more than one female was observed at the den and suggested that red foxes have "helpers," a phenomena observed in coyotes and other canids.

3.5.3.2 Red Fox Population Information

Red fox are classified by MCA §81-7-101 as a predatory animal and §87-2-101 and §87-5-102 as a nongame species in Montana, and as such may be taken year-round for any reason without a requirement to report take. MFWP does not track or attempt to estimate red fox population levels or densities. MFWP red fox population monitoring activities are based on voluntary trapper harvest survey data with catch per unit effort (CPUE) considered to be an indicator of relative population trend (Giddings 2014). Using CPUE, it appears that the population could be experiencing a slight decline since 2011-2012 (Giddings 2014), although a significant increase in CPUE in 2016 shows year-to-year variability (Figure 3.2, personal communications, David Messmer, MFWP, 7/25/2019). The red fox population in the state is still sufficiently abundant that red fox are managed as a nongame species with no limits on harvest/take. At any time, the state could adjust the regulations on this species if they felt population declines merit additional protection.

Figure 3.2 Catch per unit effort for red fox in Montana



Red fox densities have been shown to range from 0.3/mi^2 in the alpine tundra to 80/mi^2 in urban areas with abundant food (Harris 1977, MacDonald and Newdick 1982, Harris and Rayner 1986, Voigt 1987). Sargeant (1972) reported one den per 3 mi^2, or about 1.3 red fox/mi^2, conservatively estimating 4 fox per den. Population densities have been found to be 2.6 red fox/mi^2 in Ontario, Canada (Voigt 1987). Much of the available habitat in Montana, including agricultural and suburban habitats, would support densities of red fox on the higher end of this scale; very little of the State is low-density habitat such as alpine tundra (Voigt 1987). However, for purposes of this analysis, we will estimate red fox densities at 0.3/mi^2 throughout Montana, an extremely low estimate. Therefore, there are a minimum of 126,237 red foxes in Montana.

Red fox dispersal and immigration serves to replace and equalize fox densities over large areas and over a wide range of population densities (Phillips and Mech 1970, Allen and Sargeant 1993, Lieury et al. 2015). Annual harvests in localized areas in one or more years will likely have little impact on overall population in subsequent years, but may reduce localized predation (Allen and Sargeant 1993). Phillips and Mech (1970) stated that fox populations are resilient and in order for fox control operations by trapping to be successful, pressure on the population must be almost continuous. Phillips and Mech (1970) and Voigt (1987) further stated that habitat destruction that reduces prey numbers, water, and cover will affect fox populations to a greater extent than a short-term over harvest. Red fox social structure and population dynamics are similar to that for coyote, and red fox populations are likely to exhibit the same resilience to harvest as that modeled for coyotes above (Pitt et al. 2001), which is 70% annually. Long-term sustainable harvest rates for red have been reported at 64-76% (Layne and McKeon 1956) and 70% (Davis 1974) have been reported. We will use the more conservative rate of 64% as the sustainable harvest threshold, below which fox populations would not be expected to be impacted.

3.5.3.3 Red Fox Population Impact Analysis

3.5.3.3.1 WS-Montana Direct Effects on Red Foxes

In response to requests for assistance for red fox damage between FY2013 and FY2017, WS-Montana intentionally removed an annual average of 132 red foxes and an additional estimated 48 red foxes were removed from their dens during IPDM activities (Table 3.3). Included in the reported take numbers is the intentional take of red foxes in dens, estimated at four individuals per den. This estimate is based on average den occupancy, with a 50% likelihood of dens conservatively containing one adult with six pups per litter (Samuel and Nelson 1982, Wapenaar et al. 2012, Schmidly and Bradley 2016) for a total of seven red foxes. The other 50% of the time, an estimate of one red fox per den is used to account for scenarios where there is one lone adult, a den with less than six pups due to juvenile mortality or dispersal after maturation, as well as vacant dens. In addition, WS-Montana unintentionally removed an average of 2 red foxes per year during the analysis period (Table 3.3). Total red fox take by WS-Montana ranged from 115 to 257 red fox per year between FY2013 and FY2017 (Table 3.3). This level of take represents a maximum of 0.6% of the red fox population estimate in Montana, with an average of 0.4%. Red foxes were taken primarily from private lands in Montana (Table 2.2). Red foxes are captured primarily using neck snares, foothold traps, or M-44 devices (Table 2.1; Table E.1).

Based on the number of cooperative service agreements; county, state and federal budgetary constraints; and projected future requests for assistance, WS-Montana expects that future red fox removals for IPDM will be similar to take during the past five years. Therefore, under Alternative 1 (current activity level with fluctuations in the level of assistance), the projected WS-Montana annual maximum take would be 500 red foxes (Appendix E). This represents 1.1 % of the conservatively estimated red fox population, which studies estimate can withstand annual take of 64%.

Under Alternative 1, we anticipate a negligible impact on red fox locally, and no impact on statewide red fox populations in Montana. Red fox take by WS-Montana may result in a temporary decrease in localized populations where heavy IPDM is performed, but other red foxes will re-occupy these areas, so the effect will be limited to the short-term. In the long-term, the impact on local populations would be negligible. Moreover, short-term decreases in local populations are often the goal of IPDM, as discussed previously.

3.5.3.3.2 Indirect Effects

Coyotes comprise 94.1% of WS-Montana's average annual predator take, and red fox comprise only 2.65% (Table 2.2). Because coyotes and red foxes compete for habitat, the disparity in take between the species may result in local decreases in interspecific competition. This may result in increases in local red fox populations. However, coyotes are likely to re-occupy these locations due to immigration, so this effect is unlikely. Regional and statewide red fox populations are not likely to be affected. This is discussed in Section 3.8 under "trophic cascades". It is unlikely that this level of take would affect dispersal rates, dispersal distances, fecundity, or age-structure. We know of no other indirect impacts to red fox populations due to IPDM conducted by WS-Montana. We anticipate indirect impact to statewide red fox populations to be negligible.

3.5.3.3.3 Cumulative Mortality on Montana Red Fox Populations

Various sources of red fox removal contribute to the cumulative take in Montana (Table 3.3). During 2013 through 2017, recreational harvest reported to MFWP averaged 1,884 red foxes taken per year, and an average of 3 red fox per year were taken by private individuals permitted through MDOL for aerial (Table 3.3). This total cumulative take represents an annual average of 4.7% of the estimated red fox population with a maximum take of 7% in 2013.

Under Alternative 1, we anticipate similar levels of cumulative take, with a maximum cumulative take of 3,349 red fox including the WS-Montana maximum annual take of 500 individuals. This represents a maximum harvest of 7.6% of the estimated red fox population, which can withstand long-term harvest of 64%. This level of take will have a negligible impact on red fox locally, and no impact on the statewide red fox population.

As in the coyote analysis above, it is likely that some number of red fox are taken annually without our knowledge, including those taken by private citizens for PDM which are not reported. However, this number is likely to be very small compared to furbearer harvest. Moreover, due to the large disparity between cumulative take and sustainable take, the inclusion of this take (if it were known) would not affect our analysis.

Red fox populations are considered to be stable throughout their range, and they are listed as a species of "least concern" according to the (International Union for Conservation of Nature 2017).

3.5.3.4 Conclusion: Red Fox

Given the annual maximum sustainable harvest level of 64%, WS-Montana concludes that the cumulative impact of all recorded red fox mortality in Montana, including intentional and unintentional take by WS-Montana, would not adversely impact the size or sustainability of the Montana red fox population. Should an increase in requests for assistance with red fox result in the projected annual WS maximum take, cumulative impacts on the statewide red fox population would still be expected to remain low relative to the annual maximum sustainable harvest level. While there may have been a decrease in the state's red fox population, year to year variation in wildlife populations is normal, and the decline is within typical variation for red fox CPUE (Giddings 2014). MFWP continues to monitor harvest and population trends and has not changed red fox hunting or trapping regulations, which do not limit harvest. At this time WS-Montana PDM program does significantly impact the red fox population.

Table 3.3. **Population impact analysis of red fox take in Montana, FY2013-FY2017.**

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional red fox take[1]	216	85	128	139	90	**132**	**216**
Estimated WS intentional den take[1]	40	52	72	52	24	**48**	**72**
WS unintentional take[1]	1	2	2	4	1	**2**	**4**
Furbearer Harvest[2]	2,837	2,041	1,789	1,806	949	**1,884**	**2,837**
Aerial Take by MDOL permittees[3]	0	1	2	2	12	**3**	**12**
Total WS take	257	139	202	195	115	**181.6**	**257**
Cumulative Take	3,094	2,181	1,993	2,003	1,076	**2,069.4**	**3,141**
Estimated Population	44,100	44,100	44,100	44,100	44,100	**44,100**	**44,100**
WS Take % of Pop.	0.6%	0.3%	0.5%	0.4%	0.3%	**0.4%**	**0.6%**
Cumulative Take % of Pop.	7.0%	4.9%	4.5%	4.5%	2.4%	**4.7%**	**7.0%**
Projected WS Maximum Annual Take	500 red fox			1.1 % of population			
Projected Maximum Annual Cumulative Take	3,349 red fox			7.6 % of population			

[1] USDA-WS-APHIS Management Information System.
[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).
[3] Other take includes aerial shooting by private individuals permitted by MDOL.

3.5.4 What are the Direct and Cumulative Impacts on Raven Populations?

3.5.4.1 Raven Life History Information

The common raven, the largest bodied passerine, is geographically and ecologically one of the most widespread naturally occurring birds in the world (Goodwin 1976). The current raven population level in the western United States is considered to be higher than it has ever been recorded and raven numbers are rebounding in some of the raven's eastern range (Boarman and Heinrich 1999, Sauer et al. 2014).

Ravens are known for being scavengers of animal carcasses and human garbage as well as a predator of rodents, nestlings, arthropods, seeds, and grain (Boarman and Heinrich 1999). In many areas of the West, the raven is seen as an indicator of human disturbance because it is often associated with garbage dumps, sewage ponds, highways, agricultural fields, urbanization, and other typical signs of human-altered landscapes (Boarman 1993, Kristan III and Boarman 2003). Supplemental food sources such as garbage, crops, road-kills, etc., may give the raven an advantage over other less opportunistic feeders and appear to have allowed the raven population to increase precipitously in some areas. In western California, portions of the Mojave Desert raven populations have increased 1500% over the last several decades consistent with urban growth in the region (Kristan III and Boarman 2003). In Montana, raven abundance has increase significantly from 1970 to 2012 (Sauer et al. 2014).

Ravens generally are a resident species. There is no evidence of migration from radio-tagged or marked populations in North America and Iceland (Boarman and Heinrich

1999), but some wandering and local migration occurs with immature and non-breeding birds (Goodwin 1976). Typical clutch size is between 3 and 7. Immature birds, which have left their parents, form flocks with non-breeding adults. These flocks tend to roam and are loose-knit and straggling (Goodwin 1976). Further, there is some question as to whether some of the birds in flocks of floaters may be migrants (Boarman and Heinrich 1999).

Information on raven mortality including age-specific mortality rates and causes of mortality is limited. Current data from the Mojave Desert in California indicate 38% fledgling survival, 47% survival in the first year, 81% survival in the second year, 83% survival in the third year, and 83% survival for adult birds (Webb et al. 2004). Some information on the longevity of ravens in the wild is available in banding records. The oldest known wild raven from band data was 13 years and 4 months old (Klimkiewicz 2002). However, ravens have been known to live much longer in captivity (Boarman and Heinrich 1999). Mortality factors for ravens are not well known and probably include predation (including nest predation by other ravens), weather-related factors, disease, and human-induced mortality.

3.5.4.2 Raven Population Information

The common raven is managed and protected under the MBTA. The USFWS and MFWP are the agencies with primary management authority for ravens. WS-Montana responds to requests from livestock operators and others who experience depredation problems from ravens and works closely with USFWS to resolve damage complaints. Take of ravens for damage management may occur under migratory bird depredation permits issued to WS-Montana or under permits issued directly to the landowner/manager who may choose to have WS work as a sub-permittee on their permit.

The Breeding Bird Surveys (BBS) is one of the primary methods used to track trends in bird abundance. The BBS is a large-scale inventory of North American birds coordinated by the U.S. Geological Survey, Patuxent Wildlife Research Center (Sauer et al. 2014). The stated primary objective of the BBS has been to generate an estimate of population change for all breeding birds. The BBS analyzes bird population trends at the national, regional, and state levels and for Bird Conservation Areas (based on physiographic characteristics). Populations of birds tend to fluctuate, especially locally, as a result of variable annual local habitat and climatic conditions. Trends can be determined using different population equations and statistically tested to determine if a trend is significant. The breeding bird survey uses a 95% confidence interval as the credible interval for trend estimates.

To use the BBS, though, a few assumptions need to be accepted:

- All birds within a ¼ mile of the observer are seen at all stops on a BBS route; this assumption is faulty because observers often cannot see a ¼ mile in radius at all stops due to obstructions such as hills, trees, and brush and because some bird species are elusive. Therefore, the birds seen per route would provide a conservative estimate of the population.

- The chosen survey routes are fully representative of habitats in the survey area. Routes are randomly picked throughout the survey areas, but are placed on the nearest available road, which could lead to a misrepresentation of habitat types in some areas. Additionally, most BBS routes are selected because they are "off the beaten path" to enable the observer to hear birds without interruption from vehicular noise, so they may under-represent birds that have adapted to urban areas.
- Birds are equally distributed throughout the survey area. Each bird species has its own specific habitat requirements. This assumption is likely to be less of a problem for habitat generalists and birds such as ravens which use relatively abundant habitat types than for birds such as shorebirds and waders.

WS recognizes the statistical variability of the data and believes that the BBS represents the best available commercial and scientific data available to evaluate bird populations and population trends.

Population trend and distribution information obtained from the BBS can be particularly valuable in impact analyses because it can serve as a measure of the cumulative impact of all environmental factors on the species in question. BBS data for the period of 1966-2012 indicate a statistically significant increasing trend for common raven populations in Montana (3.79% per year), the Western Breeding Bird Survey Region (2.4% per year), and Nationwide (2.8% per year)(Sauer et al. 2014).

Partners in Flight (PIF) compiles a database of bird population estimates in North America. The population estimates are determined using the BBS average observations per route multiplied by the area of the region that is sampled (Blancher et al. 2013). This estimate is further refined with parameters that include detection distances, pair adjustments, and time of day adjustments to come up with an estimate of the population (Blancher et al. 2013). Methods adopted by PIF to estimate population size with BBS data yield an estimate of 60,000 ravens in Montana (Partners in Flight Science Committee 2013). Raven nesting numbers are not precisely known over broad areas, and densities in Montana probably vary throughout the state depending on the availability of food, water, and the presence of human disturbance (Boarman and Heinrich 1999). (Knight and Call 1981) summarized a number of studies on raven territories and home ranges in the western U.S. Nesting territories ranged in size from 1 pair/3.62 mi^2 - 15.7 mi^2 in Wyoming and Oregon. In coastal California where an abundant food supply was available, raven nesting pair density was found to be 1 pair/1.7 mi^2 - 2.0 mi^2 (Linz et al. 1990;1992). The densities in the Linz et al. (1990;1992) studies were probably very high as a result of human food "subsidies" and were not representative of all of California. It is likely that Montana also has sites with similar high nesting densities, although these sites are probably less common than in the more human-populated State of California. Based on nesting pair densities from studies in areas with similar BBS raven indices as Montana (Sauer et al. 2014), the raven territorial pair density in Montana could be estimated to be at least 1 pair/3mi^2-6 mi^2 or about 24,000 - 49,000 (median = 36,500 pairs) territorial pairs.

For purposes of this analysis, the following equation was used to calculate the number of fledglings produced annually in the raven population.

F = (N) x (Pb) x (Fls)

Where F represents the number of fledglings produced per year, N is the number of nesting pairs, Pb is the probability of nest success, and Fls is the average number of young fledged per successful nest.

The median number of territorial raven pairs in Montana estimated above is 36,500 territorial pairs in any one year. Boarman (USGS, 2004, personal communications) estimates that only 80% of territorial pairs will nest in a given year, which would yield an estimate of 29,200 nesting pairs in Montana. Studies have shown a 58% to 100% nesting success rate for ravens, with an average of 72.7% success (Boarman and Heinrich 1999). At the 72.7% average level, Montana would have 21,228 productive nests per year. Average (± SD) clutch size reported by Boarman and Heinrich (1999) was 5.4 ± 0.42, but average fledgling success (Yf) was 2.5 ± 0.48 birds. The average nesting success rate (72.7%) and fledging success data (2.5 per nest) yield an estimate of 53,071 fledglings produced annually. Calculations using minimum values for nest success (58%) and fledgling success (2.5 – SD = 2.02) yield an estimate of 34,211 fledglings produced per year and a total population of 73,590 ravens (Table 3.4).

The population estimate (73,590 ravens) generated by the model above including the number of territorial pairs (36,500 pairs), the number of fledglings produced per year (34,211), is higher than the PIF estimate of 60,000 ravens in Montana, and it does not include non-breeding adult birds. For the purposes of this analysis the more conservative population estimate of 60,000 ravens will be used.

The USFWS estimated sustainable harvest for a raven population in Baker County, Oregon. The estimated density of this population was 1.35/mi^2. At this density, the maximum sustainable harvest is 12% (Rivera-Milan 2019).

Table 3.4. Estimated raven population and annual mortality for Montana.

	Low Nesting and Fledging Success	Average Nesting and Fledging Success
# of Territorial Pairs	36,500	36,500
# of Nesting Pairs	29,200	29,200
% of successful nests	58%	72.7%
# Young Fledged/Successful Nest	2.02	2.5
Total Fledglings (annual production)	34,211	53,071
Total Population Post-Fledgling	107,211	89,571
Fledgling population adjusted for mortality	13,000	20,167
Adult population adjusted for mortality	60,590	60,590
Total Population Post-Fledgling adjusted for average mortality	**73,590**	**80,757**

3.5.4.3 Raven Population Impact Analysis

3.5.4.3.1 WS-Montana Direct Effects on Raven

WS-Montana receives a wide range of complaints relating to raven damage. Agriculture related complaints include damage to livestock by pecking the eyes and other soft tissues on newborn livestock, eating livestock feed, and feeding on grains and other crops. Nonagricultural property damage complaints include damage to electrical lines, power outages, soiling of satellite dishes, and holes pecked in everything from roofs to airplane wings.

WS-Montana provides technical assistance for raven damage. Very effective nonlethal preventive techniques are harassment, use of effigies, and lethal reinforcement to keep the nonlethal hazing effective. To achieve all this WS-Montana often recommends individuals seek a depredation permit from the USFWS. The majority of WS-Montana's take of ravens has been the result of requests where technical assistance has not worked for the protection of livestock. The majority of ravens are taken by use of avicide (DRC-1339) treated egg-baits.

DRC-1339, which causes death primarily due to kidney failure, is relatively slow-acting, and birds do not die at the treatment site. This makes it necessary for the attending WS-Montana Specialist to estimate the number of ravens killed. To estimate the number of ravens killed, WS-Montana specialists use a combination of monitoring the number of ravens at a site before and after treatment, watching ravens during treatment, and monitoring the number of eggs consumed. Each of these strategies has its strengths and weaknesses. The number of birds at a site may decrease for reasons not related to the use of DRC-1339 (e.g., a roadkill carcass or spilled food attracts scavenging ravens); the amount of avicide needed for a lethal dose varies among individual ravens (each egg contains approximately 1.5 times the amount needed to kill half the birds tested (LD_{50})), and ravens may consume or cache more than one egg.

The number of egg-baits taken per raven taken varies, ranging from about 1 to 4. Recent research using videography indicates that the traditional 1:2 ratio (ravens to missing eggs) used by managers to estimate raven take may result in substantial overestimation, especially if non-target species, such as ground squirrels, begin consuming egg baits (Coates et al. 2007) (See Section 3.7 for more information on DRC-1339 effects on non-target species). This research enforces WS-Montana belief that it may be overestimating raven take. The impact analysis below is designed to be extremely sensitive to any impacts on ravens in Montana because we have used a liberal estimate of WS-Montana take and a conservative estimate of the Montana raven population.

In response to requests for assistance for raven damage between FY2013 and FY2017, WS-Montana dispersed an annual average of 37 ravens and intentionally removed an annual average of 121 ravens. An additional estimated 2.5 ravens (Boarman and Heinrich 1999) were removed from their nest during IPDM activities in FY2016 (Table 3.5). WS-Montana did not unintentionally remove any ravens during the analysis period (Table 3.5). Total lethal raven take by WS-Montana ranged from 17 to 239 ravens per year between FY2013 and FY2017 with an annual average of 121 (Table 3.5). This level of take represents a maximum of 0.4% of the raven population estimate in Montana, with an average of 0.2%. Ravens were taken primarily from private lands in Montana (Table 2.2). DRC-1339 is the primary method used by WS-Montana to remove ravens (Table 2.1; Table E.1).

Raven take by WS-Montana varies considerably from year to year, and we anticipate such variation in future years. Based on the number of cooperative service agreements;

county, state and federal budgetary constraints; and projected future requests for assistance, WS-Montana expects that future raven removals for IPDM will not exceed 500 ravens annually (Appendix E). This represents 0.8% of the conservatively estimated raven population, which is unlikely to impact raven populations in Montana. Furthermore, WS-Montana take, especially take associated with congregation sites such as calving grounds, airports, and landfills, would likely impact the floater segment of the raven population more than the less mobile territorial pairs. Boarman and Heinrich (1999) cite Sherman (1993) as reporting that nesting ravens in the Mojave Desert of California spent 75% of foraging time within 437 yards of the nest. Dorn (1972) also reports that, in many areas, breeders probably remain near their territories throughout the year. Therefore, it is unlikely WS-Montana's take would impact the breeding population of ravens in Montana.

3.5.4.3.2 Indirect Impacts

Common ravens are most often removed from private land in response to agricultural damage and secondarily are removed from airport environments to reduce hazards to aircraft and human safety (Table 2.1, 2.2). The low-magnitude of WS-Montana's average annual lethal take of common ravens (0.2%) would have a low level of impact on local and state populations and would likely not be discernable from natural mortality events. Additionally, considering that most of these activities will occur on private land, the general public would not likely notice a decline in local populations. Raven populations utilizing anthropogenic food resources are at unnaturally high local abundance levels across the west. Ravens are a species that seems to adjust well to human populations and benefits from anthropogenic resources. As the population of Montana continues to grow there will likely be additional anthropogenic resources available to ravens resulting in greater population growth and harmful population level impacts to native species depredated by ravens.

3.5.4.3.3 Cumulative Mortality

Various sources of raven take contribute to the cumulative take of ravens in Montana (Table 3.5). The USFWS issues Federal Migratory Bird Depredation Permits to individuals and entities for lethal take of ravens when conditions warrant. These permits designate the species (ravens), methods, and the number of birds that may be taken, and are only valid for the individuals named on the permits, permit locations, and dates of the permit. Illegal shooting is not likely to be a major contributor to the cumulative mortality because ravens quickly learn to avoid humans with firearms after witnessing a raven being shot.

To estimate maximum cumulative annual take, we analyzed both the take reported to the USFWS through Migratory Bird Depredation Permits and the take permitted through Migratory Bird Depredation Permits. Raven take reported to the USFWS varied from 0 to 40 and averaged 17 ravens annually between FY2013 and FY2017. Take authorized by the USFWS by Migratory Bird Depredation Permit varied from 275 to 472.5 and averaged 377 over the same reporting period.

Cumulative take, including total take from WS-Montana, ranged from 28 to 279, with an average of 139 per year (Table 3.5). This corresponds to an average annual cumulative take of 0.23%, with a maximum of 0.5% of the estimated raven population in Montana with WS-Montana contributing 0.03% to 0.4% of the cumulative amount (Table 3.5).

Using the estimated rate of population increase from the Western BBS region of 2.4% per year and the estimate of 60,000 ravens in Montana, approximately 1,440 ravens per year are added to the Montana raven population annually, even with current rates of raven removal. The estimated maximum rate of raven removal of 1.6% (projected maximum annual cumulative take of 973 ravens, Table 3.5) would be lower than the estimate of birds added per year and would not reduce the overall raven population, although it may reduce the rate of overall population increase depending on the extent to which mortality attributable to WS-Montana is compensatory to other causes. Mortality attributable to WS-Montana is likely at least partially compensatory to other forms of mortality. WS-Montana often takes ravens from flocks of "floaters" at raven congregation sites. Many of these birds are young birds without breeding territories. Data from Webb et al. (2004) indicates that first year birds have much lower survival than older birds. Given this analysis, WS-Montana concludes that this alternative will have a low impact on the raven population.

Raven populations are considered to be increasing throughout their range, and are listed as a species of "least concern" according to the (International Union for Conservation of Nature 2017).

3.5.4.4 Conclusion: Ravens

Given the increasing population trend for ravens in the state, the low unintentional take, and low cumulative take (Table 3.5), impacts on the raven population from all causes, including take by WS-Montana, is not adversely impacting the population. Therefore, WS-Montana concludes that the cumulative impact of all recorded raven mortality in Montana, including intentional and unintentional take by WS-Montana, is not adversely impacting the size or sustainability of the Montana raven population. In addition, the USFWS monitors cumulative impacts through the MBTA to ensure the health and sustainability of the raven population; therefore, WS-Montana's impact on the population has a built-in measure to assure that WS-Montana does not have an adverse cumulative impact on the population.

Should an increase in requests for assistance with raven damage result in the projected annual WS maximum take, cumulative impacts on the statewide raven population would be expected to increase. However, given the low proportion of cumulative take, and even lower WS-Montana take, direct and cumulative impacts from take would not adversely impact the size or sustainability of the raven population.

Table 3.5. Population impact analysis of raven take in Montana, FY2013 - FY2017.

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
Ravens dispersed by WS[1]	44	8	9	93	29	**37**	**93**
WS intentional raven take[1]	239	194	95	14	63	**121**	**239**
Estimated WS intentional nest take[1]	0	0	0	2.5	0	**1**	**2.5**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
Take reported to USFWS[2]	40	14	0	11	20	**17**	**40**
Non-WS take permitted by USFWS[2]	398	130	100	460	420	**302**	**460**
Non-WS nest take permitted by USFWS[2]	0.0	175.0	175.0	12.5	12.5	**75**	**175**
Total non-WS take permitted by USFWS[2]	398	305	275	472.5	432.5	**377**	**472.5**
Total WS take	239	194	95	17	63	**122**	**239**
Cumulative Take	279	208	95	28	83	**139**	**279**
Estimated Population	60,000	60,000	60,000	60,000	60,000	**60,000**	**60,000**
WS Take % of Pop.	0.4%	0.32%	0.16%	0.03%	0.11%	**0.2%**	**0.4%**
Cumulative Take % of Pop.	0.47%	0.35%	0.16%	0.05%	0.14%	**0.23%**	**0.5%**
Projected WS Maximum Annual Take	**500**	**ravens**			**0.8%**	**of population**	
Projected Maximum Annual Cumulative Take	**973**	**ravens**			**1.6%**	**of population**	

[1] USDA-WS-APHIS Management Information System.
[2] Data from USFWS MB-SPITS Species Tracking Summary Report compiled 8/29/2016 and 8/22/2018 compiled by Kelly Gonzales.

3.5.5 What are the Direct and Cumulative Impacts on Gray Wolf Populations?

3.5.5.1 Gray Wolf Life History Information

The gray wolf is a habitat generalist except for the presence of ungulates within its territory on a year-round basis. Historically, gray wolves occurred across all vegetation types in Montana where there was adequate prey. Hence, current day wolf habitat is defined more specifically by ungulate distribution and human settlement patterns (Montana Fish Wildlife and Parks 2003).

Wolves are opportunistic carnivores. The primary prey species for wolves in Montana are deer, elk, and moose (Boyd et al. 1994); however, cattle and sheep are at least twice as numerous as wild ungulates, even on public lands (U.S. Fish and Wildlife Service 1994). The only areas that lack livestock and are large enough to support wolf packs are Yellowstone National Park, Glacier National Park, some adjacent USFS Wilderness Areas, and parts of Wilderness Areas in central Idaho and Northwestern Montana. Consequently, every wolf pack outside these areas has interacted with livestock, primarily cattle. Livestock and livestock carrion are routinely used by wolves, but wolf management discourages chronic killing of livestock (U.S. Fish and Wildlife Service 1994, Montana Fish Wildlife and Parks 2003, U.S. Fish and Wildlife Service 2009).

In Montana, wolves are primarily distributed in the western area of the state inhabiting private, tribal, and public lands. The majority of Montana wolf packs, ranging from 2 to 22 wolves (Boyd et al. 2017), live in areas where mountainous terrain and intermountain valleys are intermixed on varying land ownership (Sime et al. 2011). Packs typically consist of a socially dominant (alpha) pair, their offspring from the previous year, and new pups. Other breeding age adults may be present and occasionally reproduce in areas with high prey densities (Ballard et al. 1987); however, survival of these pups is highly variable. Pups are typically born in late April with litters averaging 5.3 pups (Montana Fish Wildlife and Parks 2003). Pups move from the den when they are 3 months old to rendezvous sites throughout the pack's territory (Packard 2003).

Pack territories are dynamic and can change annually with prey availability and relationships with neighboring packs. The average pack territory in Montana encompasses 27% private land (Hanauska-Brown et al. 2012). The maximum territory size calculated for a Montana wolf pack in 2011 was 480 mi^2, but most pack territories were found to be significantly smaller (Hanauska-Brown et al. 2012). The mean pack size between 2008 and 2009 was 232 mi^2 (Rich et al. 2012).

Wolves typically disperse between 1-2 years old as they reach sexual maturity. The average dispersal distance from natal territories is 62 miles (Boyd and Pletscher 1999, Boyd et al. 2017) with some gray wolves dispersing up to 500 miles. Dispersal peaks in mid-winter and late spring (Boyd and Pletscher 1999). At any point in time 5-20 percent of the wolf population may be dispersing individuals.

3.5.5.2 Gray Wolf Population Information

Wolves in the northern Rocky Mountains were first listed as endangered in 1973 (38 FR 14678). In the 1980's and 1990's, wolves increased in number and distribution through natural emigration from Canada and a successful reintroduction of wolves into Yellowstone National Park and wilderness areas of central Idaho. The gray wolf population in the northern Rocky Mountain States met the criteria for recovery in 2002. Nine years after having met recovery goals, the USFWS published a notice in the Federal Register on May 5, 2011 (76 FR 25590-25593), enacting the final rule (74 FR 15123-15188) removing wolves from the list of T&E species in Idaho and Montana as well as portions of eastern Oregon and Washington, and north-central Utah. Under the final rule, the wolf population in Montana is to be managed by MFWP (MCA §87-1-901) as a species in need of management and maintained above the recovery level of 10 breeding pairs by managing for a total of at least 15 breeding pairs according to the Montana Gray Wolf Conservation and Management Plan (Montana Fish Wildlife and Parks 2003). Under this plan, wolves are not deliberately confined to any specific geographic areas of Montana nor is the population size deliberately capped at a specific level. Wolf numbers and distribution are managed adaptively based on ecological factors, wolf population status, conflict mitigation, and human social tolerance. State law clarifies that the primary goal of the department in managing wolves is to protect humans, livestock, and pets, and preserve citizens' opportunities to hunt large game (MCA §87-1-217). This law further states that wolves with a history of livestock predation may be lethally removed is the state objective for breeding pairs has been met.

Since 2012, MFWP has managed gray wolves in Montana through hunting and trapping seasons, by allowing private citizens to kill wolves under specific circumstances, and by authorizing removals to manage conflicts with livestock. Federal and state regulations in place since 2009 have allowed private citizens to kill wolves found in the act of attacking, killings, or threatening to kill livestock (Boyd et al. 2017). Senate Bill 200 approved in 2013 allows landowners or their agents to take wolves that are a "potential threat" on their private property without a hunting license. Hunting and trapping seasons allow an individual to take up to 5 wolves with a combination of hunting and trapping licenses. Prior to the 2013-2014 season, wolf take was limited to 3 wolves per person, and in the 2011-12 season wolf take was 1 per hunter with no trapping season.

Wolf-livestock conflict management in the state has also changed. At the time of delisting, MFWP was responsible for making all decisions regarding on-the-ground management of wolf-livestock conflicts. Currently, WS-Montana works under the authority of MFWP to identify, target, and remove wolves responsible for livestock losses according to the Montana Protocol to Address Wolf-Livestock Conflicts (implemented December 6, 2012) and the current MOU, and MFWP is responsible for handling all non-livestock complaints involving gray wolves. This protocol requires lethal control to be reported to MFWP wolf specialists within 48 hours.

At the time of delisting, the minimum count in Montana was 653 wolves in 130 packs and 39 verified breeding pairs (Hanauska-Brown et al. 2012). With the many wolf management methods described above, "the wolf population has decreased slightly and may be stabilizing" (Montana Fish Wildlife and Parks 2018). In 2017, MFWP confirmed the presence of at least 633 wolves in 124 packs and 63 breeding pairs. The 2017 monitoring criteria are well above the management goals of at least 15 breeding pairs and 150 wolves (Montana Fish Wildlife and Parks 2003). While these criteria (at least 15 breeding pairs and 150 wolves) will continue to be used as metrics for a healthy, sustainable population by MFWP (Montana Fish Wildlife and Parks 2003;2018) and in this EA, the population monitoring techniques used by MFWP to evaluate these criteria are being updated. Minimum counts are a product of intensive monitoring and "were appropriate and achievable when the wolf population was small and recovering" (Montana Fish Wildlife and Parks 2018). During this time most wolf packs had radio-collared individuals, but for the last decade with the wolf population approaching or above 500, minimum counts have reflected "total effort as much as population status" (Montana Fish Wildlife and Parks 2018). MFWP is moving from minimum counts to a patch occupancy model to estimate the number of wolves and packs in Montana. During 2013-2017 the minimum count of wolves in Montana ranged from a 5-year low of 477 in 2016 to 633 in 2017 (Bradley et al. 2014, Bradley et al. 2015b, Coltrane et al. 2015, Boyd et al. 2017, Montana Fish Wildlife and Parks 2018)(Figure 3.3). Population estimates generated from the patch occupancy model are higher ranging from a 5 year low of 851 (95% confidence interval = 673-1,062) in 2016 to a high of 1,065 (95% confidence interval = 849-1,313) in 2013 (Figure 3.3).

The average minimum count between 2013 and 2017 is 565 gray wolves. This value does not accurately reflect the number of wolves in Montana. MFWP in Boyd et al. (2017) states, "Minimum counts were achievable and appropriate when wolf numbers were low (for example prior to 1995 year end wolf counts were <75), but the technique has become unduly expensive and unachievable as population expand and increase. During 2016, [M]FWP's minimum count goal was to verify the presence of at least 150 wolves and 15 breeding pairs as required by the state management plan. Our goal was not, as it has been in the past, to attempt to count every pack, wolf, and breeding pair." The average from the patch occupancy model over the last 5 years of available data (2012-2016) is 931 gray wolves. We will use this value as a population estimate when evaluating impacts on the wolf population because it is based on the most current method for evaluating gray wolf population size developed by MFWP (Montana Fish Wildlife and Parks 2018).

Wolf populations are dynamic and can undergo major fluctuations. Many studies have examined various levels of mortality and harvest and the impacts these mortality levels have on gray wolf populations. Wolf populations have sustained human-caused annual mortality rates of 30 to 50% without experiencing declines in abundance (Keith 1983, Fuller et al. 2003). Based on mean pack size of 8, mean litter size of 5, and 38% pups in packs, Boertje and Stephenson (1992) suggested 42% of juveniles and 36% of adults must be removed annually to achieve population stability. While Mech (1970a) suggested that more than 50% of wolves older than 5-10 months must be killed to control population size, other researchers have indicated declines may occur with human-caused mortality at 40% or less of fall wolf populations (Peterson et al. 1984, Ballard et al. 1987). Gasaway et al. (1983) reported stable wolf populations after early winter harvests of 16 to 24%, and wolf population declines of 20 - 52% after harvests of 42 - 61%. Ballard et al. (1997) suggests that the wolf population remained stable at 53% winter mortality, which included both natural and human-caused mortality. Fuller (1989) observed stable or slight increases in a wolf population with an annual human-caused mortality rate of 29%. Fuller et al. (2003) concluded that up to 35 % human-caused mortality of late fall or winter population could be tolerated by most wolf populations without causing population declines. In their analysis of multiple data sets, Adams et al. (2008) found human-caused mortality rates <29% did not cause wolf population declines.

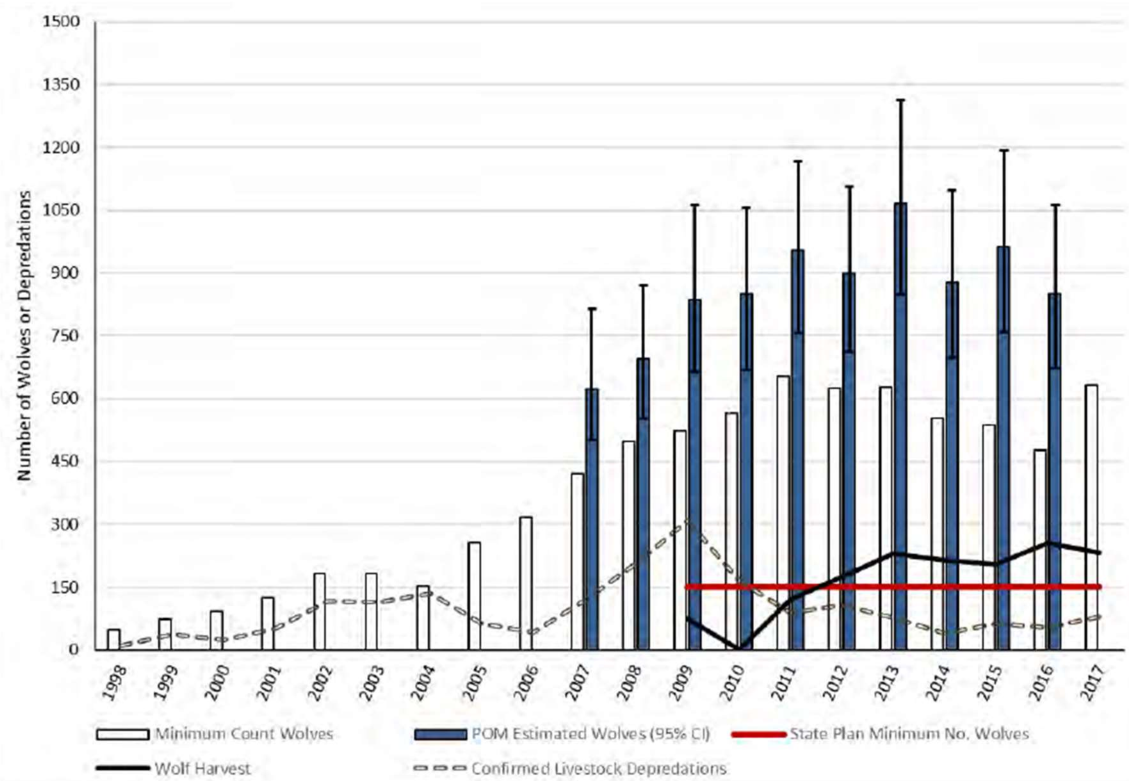
Haight et al. (2002) modeled the impacts of various wolf removal strategies for damage management including reactive removal (wolves removed after depredation occurs), delayed corrective removal (wolves removed in winter from areas with a history of wolf conflicts), and population size management (wolves removed annually from all territories near depredation sites). None of the strategies threatened wolf populations unless the wolf population was isolated. The model predicted that populations could withstand a sustained harvest of 20-25%. The authors considered this to be a conservative estimate and that the model likely underestimated compensatory factors in wolf population biology.

Creel and Rotella (2010) noted that most assessments of the ability of wolf populations to withstand human-caused mortality assumed that human-caused mortality was compensated for by density-dependent reductions in non-harvest mortality factors. The authors used data from existing studies of wolf populations, and USFWS reports for the northern Rocky Mountain wolf population published through 2008 to assess the impact of human-caused mortality on total mortality and the impact of human-caused mortality on wolf population growth rates. Based on their modeling, Creel and Rotella (2010) concluded that human-caused mortality was actually highly additive to or potentially super-additive to natural mortality. Borg et al. (2015) evaluated the impact of human harvest on the wolf population and pack structure in Denali National Park and Preserve and also concluded that human-caused mortality may be a largely additive source of mortality in wolves. Super-additive mortality rates might occur in situations wherein wolf removals disrupt pack structure such that breeding activity was disrupted. Risks associated with pack disruption and associated impacts on the response of wolf populations to human-caused mortality were identified as being particularly great for small packs with 4 or fewer adults. However, the authors also found little evidence of density dependence in wolf population growth rates which could have been an indication that the population was below its ecological carrying capacity and that density-dependent factors did not have strong influence on population dynamics at that time. The authors concluded that while wolf populations could be harvested sustainably, within limits, human-caused mortality was additive to other factors and the level of harvest that could be sustained was likely lower than predicted in other studies. Creel and Rotella (2010) concluded that northern Rocky Mountain populations could sustain harvests of approximately 22% of the population.

Haber (1996) reported that wolf populations may not be able to withstand repeated annual reductions of 25-50%. He believes these removals, in the form of hunting, trapping, and government control efforts, may have impacts on wolf population dynamics, social interactions, and the long-term health of the population. Haber also reported that it is difficult to fully understand the impacts of wolf exploitation because detailed comparative information on behavior from both exploited and protected wolf populations is scarce.

The management goals of at least 15 breeding pairs and 150 wolves (Montana Fish Wildlife and Parks 2003) has been used by MFWP and USFWS to ensure a healthy wolf population in Montana. In MFPW's wolf conservation and management plan MFWP states, "an adaptive management approach based on 15 breeding pairs will provide a spectrum of management tools.…will sustain the wolf population and allow wolves to find their place on the landscape. Additionally, the adaptive framework will provide [M]FWP with the flexibility to adjust management to wolf numbers, wolf distribution, public acceptance, prevailing landownership patterns, land uses, prey populations, and other considerations (Montana Fish Wildlife and Parks 2003)." This metric will be used in this EA to evaluate the impacts on wolves in Montana.

Figure 3.3. Number of wolves in Montana 1998-2017 (Montana Fish Wildlife and Parks 2018).



3.5.5.3 Gray Wolf Population Impact Analysis

3.5.5.3.1 WS-Montana Direct Effects on Gray Wolves

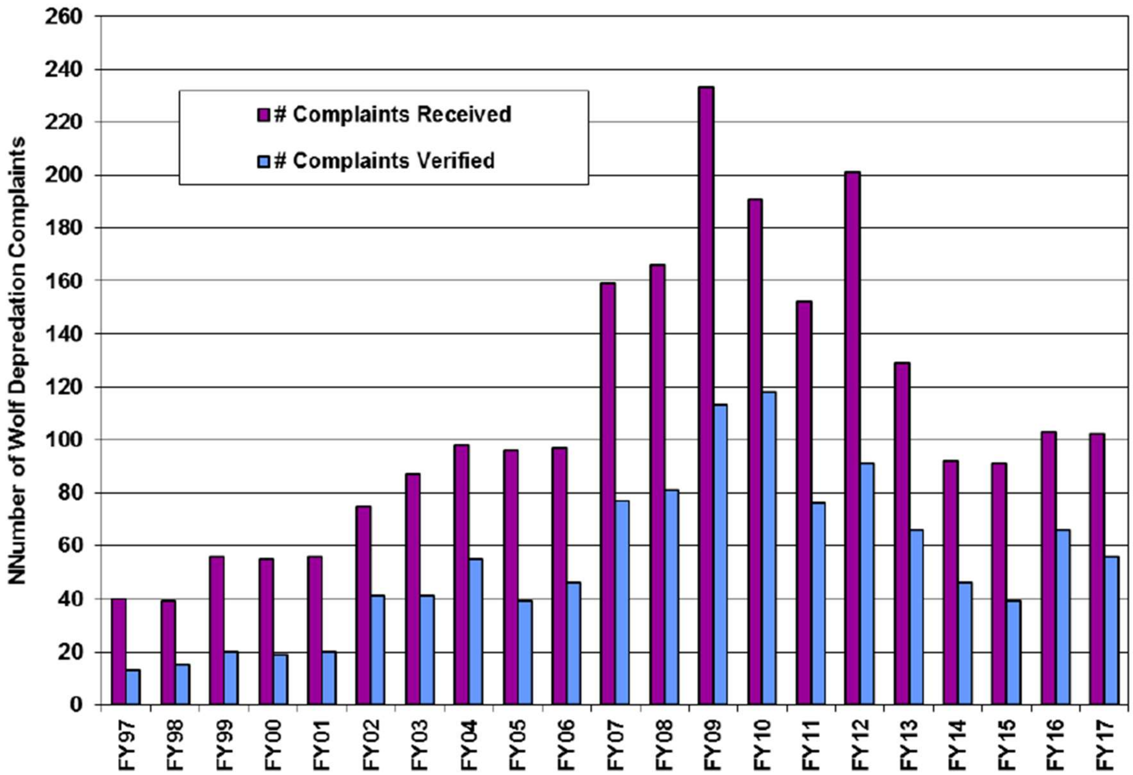
WS-Montana received increasing numbers of requests for assistance with wolf-livestock conflicts through 2009 as the wolf population increased and the distribution expanded (Figure 3.4). The number of complaints has declined from 233 in FY2009 to approximately 100 or less from FY2014 – FY2017 (Figure 3.4). Despite the decline in complaints, during FY2013 – FY2017, gray wolves were responsible for 12.5% of the livestock losses recorded by WS-Montana, and 28% of the value of all losses due to predators. The value of livestock losses from gray wolves averaged $346,690 per year (Table 1.6). In 2018 and 2019, WS-Montana hired a conflict prevention specialist with cooperative funding from Defenders of Wildlife and Natural Resources Defense Council to protect cattle from wolf depredation during the calving season, when calves are most vulnerable to predation and a range rider to protect cattle from wolves on summer grazing allotments on the Kootenai National Forest. In 2020 WS-Montana hired a second conflict prevention specialist and another range rider to protect cattle from wolves on summer grazing allotments on the Beaverhead-Deer Lodge National Forest. Gray wolves made up 0.78% of WS-Montana predator take from FY2013 - FY2017. Gray wolves are generally taken by aerial shooting (68%), foothold traps (16%), firearms (13%), and neck snares (3%) (Table 2.1; Table E.1). Over half of gray wolf take during this period has been on private land (64%; Table 2.2) with the remaining take occurring on a variety of lands including Forest Service, tribal and state lands, and BLM

(Table 2.2).

While the impact analyses for the majority of species in this EA use data from the federal fiscal year, which most closely overlaps the hunting and trapping seasons, wolf harvest and mortality data is presented by MFWP per calendar year (CY). Therefore, for wolf population impact analyses, we will present WS-Montana take per calendar year.

In response to requests for assistance with gray wolf damage between CY2013 and CY2017, WS-Montana intentionally removed an average of 52 gray wolves a year (Table 3.6). WS-Montana unintentionally removed 2 gray wolves during the analysis period (Table 3.6). WS-Montana total take ranged from 38 to 71 wolves annually between CY2013 – CY2017. This corresponds to an average of 5.6%, with a maximum of 7.6%, of the estimated gray wolf population in Montana (Table 3.6). Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future gray wolf removals for IPDM would be similar to take during the last five years. Under Alternative 1, we anticipate that WS-Montana would take no more than 100 gray wolves. This corresponds to 8.6% of the estimated statewide gray wolf population (Appendix E) well below the thresholds for maximum sustainable harvest discussed above which ranged from 20-50% (Section 1.5.5.2). Local populations of gray wolves may temporarily be affected. For example, pack removal could result in a territory being unoccupied for a year; however, immigration will likely counteract this effect (Bjorge and Gunson 1985, Bradley et al. 2015a) and, long-term, populations would not be affected. Under Alternative 1, we anticipate that WS-Montana IPDM would have a negligible impact on gray wolf populations locally or statewide.

Figure 3.4. Number of suspected wolf damage complaints received and verified by WS-Montana between FY1997 and FY2017 (Montana Fish Wildlife and Parks 2018).



3.5.5.3.2 Indirect Impacts

Removal of wolves may have indirect impacts on the remaining wolves and packs that are not immediately reflected in counts of individuals in the wolf population. Potential indirect impacts may include changes in the genetic relatedness of individuals in packs and the social stability of packs (Rutledge et al. 2010, Wallach et al. 2015), the potential for suboptimal genetic traits to be selected-for resulting in reduced fitness (Darimont et al. 2009, Darimont et al. 2015), and changes in stress and reproductive hormones that may adversely impact the long-term health of the population (Bryan et al. 2014).

Rutledge et al. (2010) observed a decline in the degree of relatedness among individuals in wolf packs within a protected area, Algonquin Park, Canada, surrounded by an area of intensive hunting pressure. Wolf density did not change substantially after harvest was discontinued in the buffer area around the park, but the incidence of adoption of unrelated individuals into packs within the park declined substantially. Rutledge et al. (2010) hypothesized that restoring the high degree of relatedness among individuals may allow evolutionary processes to occur in response to natural selection and not human-mediated mortality. The authors suggest that conservation strategies that support natural selection may enhance the ability of populations to adjust to changing environmental conditions such as climate change.

Darimont et al. (2009) assesses the impact of human harvest pressure on specific phenotypes of prey species and report that their analysis of 29 species (21 fish, 4 invertebrates, 2 ungulates, and 2 plants) demonstrates phenotypic change over time as a consequence of human harvest. Harvest was primarily associated with commercial harvest. Given the lack of terrestrial vertebrates in the sample of species reviewed, we question the applicability of this information to wolves and wolf removals for WDM. Additionally, removals for WDM do not in any way begin to approach commercial harvest in terms of intensity of effort or numbers harvested. Consistent with Darimont et al. (2009), Darimont et al. (2015) notes that humans harvest animals at rates far greater than that of other predators in the ecosystem, and that unlike mortality from other predators, human harvest disproportionately affects adult animals (i.e., reproductive adults). In cases where sport-hunting is intense, individuals with specific phenological traits (i.e., large body mass, antlers, etc.), are sought disproportionally which may affect the genetic structure of the population.

After careful review of the information in Rutledge et al. (2010) and Darimont et al. (2009), Darimont et al. (2015) we do not believe the findings of these studies are directly applicable to conditions that may occur under Alternative 1. First, in lethal PDM, the removal of only wolves and packs associated with livestock predation is planned. Selections are made based on non-physical attributes, and potential selection pressure similar to that reported by Darimont et al. (2009) and Darimont et al. (2015) would not be expected. This conclusion is supported by data from Stark and Erb (2014) which indicate that the assumption that hunting targets older individuals may not be accurate for wolf harvest in Minnesota. This data showed that over 60% of the wolves taken by hunters in 2013 were either young of the year or 1 year old individuals. Similarly in 2012, 2013, and 2017, 71%, 87%, and 60% of wolves, respectively, harvested by hunters in the Wyoming Trophy Game Management Area were young of the year or subadults (1-2 years old)(Wyoming Game and Fish Department et al. 2013;2014, Wyoming Game and Fish Department et al. 2018).

Bryan et al. (2014) documented increased levels of stress hormones and reproductive hormones in wolves from tundra regions subjected to intensive hunting pressure when compared to forested regions where there was presumably less hunting pressure. The authors admit that their study’s analysis was unable to completely differentiate between potential effects from other environmental factors and the hunting effect. The study did not collect any concurrent data on the reproductive biology and behavior of the affected packs, and instead presented hypothesis on reasons for the observed differences from information in the literature. Additionally, Bryan et al. (2014) provided no information on the level of wolf removals as a proportion of the wolf population that would enable extrapolation of their study results to other areas and differing types of wolf removals. While there are methodological problems with this design that limit the utility of the study, the study does raise interesting questions which we are considering here.

We are not surprised that Bryan et al. (2014) found measurable, hormonal responses (reproductive and stress hormones) in wolves subjected to “heavy rates” of hunting pressure. As noted by the authors, “Physiological responses are adaptive mechanisms by which organisms respond to complex interactions among individual, social and environmental conditions.” Bryan et al. (2014) concluded that the observed differences likely reflected an interaction of hunting pressure, habitat, and sampling method. The study did not provide sufficient evidence to make predictions regarding the consequences of the observed differences for the wolf population. As noted above, at least some of the changes may be the beneficial response that enables populations to sustain some level of human removals (e.g., increased reproduction). The authors called for additional research to help clarify the cause of the observed changes and determine the impact of the observed changes on wolf populations. Bryan et al. (2014) also recommended that agencies may want to consider factors other than population size such as hormonal and genetic changes when assessing the health of wolf populations.

Wallach et al. (2015) discusses the importance of apex predators in native ecosystems and establishes a formal definition of an apex predator based on the extent to which social and biological factors (e.g., territoriality, pack structure, female reproductive suppression) and not top-down or bottom-up processes limit the species population. The authors express concern that human persecution may disrupt social-stability in apex predator populations. In their opinion, perturbations in social stability may adversely impact the ability of the population to self-regulate via mechanisms such as female reproductive suppression and territoriality, and may also alter predation efficacy by perturbing cooperative foraging behavior. Shifts in hunting efficacy may result in changes in prey taken by packs and indirectly affect the impact of apex predators on prey populations (See Section 3.5.5.3.3 for discussion of impacts of wolf removals on the role of wolves in ecosystems). However, the extent to which this is an issue for Montana is unclear.

Many of the studies discussing disruptions to pack social structure as a result of lethal removals consider potential impacts on wolf populations and ecosystems that are not strictly related to the size of the wolf populations. It is not surprising that wolf removals can result in differences in predators without necessarily changing the wolf population density or size. Ultimately, the issue of concern is not whether differences can be measured, but what these differences mean for the population and its interactions with prey and habitat. Available data indicate that disruption does not necessarily result in adverse impact on the overall wolf population (Nadeau et al. 2008, Nadeau et al. 2009) (U.S. Fish and Wildlife Service et al. 2008, U.S. Fish and Wildlife Service et al. 2009, Mack et al. 2010, U.S. Fish and Wildlife Service et al. 2010). Pack resilience to mortality is inherent in wolf behavioral adaptation and reproductive capabilities (Brainerd et al. 2008). Pack dynamics, social status, movements, and certain aspects of seasonal habitat use are all affected by wolf reproductive behavior. Gray wolf packs normally consist of young of the year, several sub adults and the dominant male and female that can reproduce annually (Mech 1970b). Lack of reproduction among sexually mature subordinate pack members is considered common (Packard et al. 1985), but increases in the occurrence of multiple breeding females have been documented (Mech 1999, Smith and Guernsey 2002, U.S. Fish and Wildlife Service et al. 2002, Mech et al. 2003, Mech and Boitani 2003, Brainerd et al. 2008). Brainerd et al. (2008) found that 62% of packs in recovering populations retained territories despite breeder loss, and of those who lost territories, one-half became re-established. Furthermore, pup survival was primarily dependent on size of pack and age of pup because multiple pack members feed pups despite loss of a breeder. Pup survival in 84% of packs with breeder loss was similar or higher than packs without breeder loss (Mech and Boitani 2003).

Contrary to the conclusion of some studies listed in this section, we believe that population size is an appropriate index to assess the long-term, well-being of the wolf population. Impacts that ultimately impair the ability of a population to respond to environmental factors, such as climate change, will be reflected in reduced survivorship or reproductive success and ultimately decreased population size.

Although some studies discussed above noted differences in wolves subjected to heavy hunting pressure, the long term consequences of these differences for wolf populations and their role in ecosystems are largely unproven and theoretical. In the absence of conclusive data, the key factor in determining significance, is the extent to which the responsible agencies will monitor for and adapt to indications of unintended adverse cumulative impacts on the wolf population. This is especially true given that at least some of the differences observed appeared to be readily reversible. For example, restoration of "natural" social structure and relatedness in packs was restored relatively rapidly after establishment of buffer areas around a national park to reduce loss of wolves that wander outside the park (Rutledge et al. 2010).

3.5.5.3.3 Cumulative Mortality

Various sources of gray wolf removal contribute to the cumulative take in Montana (Table 3.6). MFWP reported an average of 227 gray wolves taken by hunters and trappers annually between CY2013 and CY2017 (Bradley et al. 2014, Bradley et al. 2015b, Coltrane et al. 2015, Boyd et al. 2017, Montana Fish Wildlife and Parks 2018), which is 33.6% of the estimated gray wolf population (Table 3.6). Additional known harvest includes take by private citizens to protect livestock ranging from 7 to 16 wolves annually between 2013 and 2017 under the Defense of Property Statue or Senate Bill 200. Additional mortalities (reported as "Other Take" in Table 3.6) ranged from 9 to 20 during the analysis period and include wolves killed by collisions with vehicles and trains, incidental take as a result of capture for monitoring purposes, wolves euthanized, and mortalities identified for which the cause is known. Known illegal take varied between 1 and 10 wolves annually between 2013 and 2017. Undoubtedly, additional illegal harvest occurred, but was not detected. As in the coyote and red fox analyses above, this number is likely to be very small compared to legal harvest levels. Known cumulative take, including total WS-Montana take averaged 312 wolves a year with a maximum of 338. The average annual cumulative take corresponds to 33.6% of the gray wolf population estimate with a maximum take of 36.3% (Table 3.6).

Under Alternative 1, we anticipate similar levels of cumulative take, with a maximum cumulative take of 401 gray wolves including the WS-Montana maximum annual take of 100 individuals (Table 3.6). This represents a maximum harvest of 43.1% of the estimated gray wolf population (Table 3.6), which can withstand long-term harvest of 20% to 50% (See Section 3.5.5.2). It is likely that the gray wolf population has stabilized after a slight decline under the current level of exploitation (Montana Fish Wildlife and Parks 2018). MFWP closely monitors population levels, harvest, lethal control for livestock protection, and other measurable sources of mortality (Bradley et al. 2014, Bradley et al. 2015b, Coltrane et al. 2015, Boyd et al. 2017, Montana Fish Wildlife and Parks 2018)and has increased harvest opportunities since wolves were delisted (Section 3.5.5.2). The WS-Montana proposed maximum take would not contribute substantively to existing impacts regulated directly by MFWP. Moreover, MFWP has maintained this level of harvest while recruitment, estimated from the patch occupancy model, has exceed the recruitment threshold of 15 breeding pairs by 493% to 1,633% since 2008 (Montana Fish Wildlife and Parks 2018).

U.S. Fish and Wildlife Service (1987) initially specified a recovery criterion of a minimum of 10 breeding pairs of wolves for a minimum of 3 successive years in each of 3 core recovery areas. U.S. Fish and Wildlife Service (1994) subsequently revised wolf recovery parameters in the northern Rocky Mountains (NRM) to stipulate that "Thirty or more breeding pairs comprising some 300+ wolves in a metapopulation, with genetic exchange between subpopulations, should have a high probability of long-term persistence." In addition, the metapopulation configuration and distribution throughout secure suitable habitat (e.g., Yellowstone National Park, northwestern Montana and central Idaho) would ensure that each core recovery area would provide a recovered population that would be distributed over a large enough area to provide resilience to natural or human-caused events that might temporarily affect one core recovery area. U.S. Fish and Wildlife Service (1994) further determined that a metapopulation of this size distributed among the three core recovery areas within the identified NRM distinct population segment would result in a wolf population that would fully meet recovery objectives.

The USFWS conducted another review of what constitutes a recovered wolf population (U.S. Fish and Wildlife Service et al. 2002, U.S. Fish and Wildlife Service et al. 2003) to re-evaluate and update U.S. Fish and Wildlife Service (1994). A majority (78%) of a panel of wolf experts supported U.S. Fish and Wildlife Service (1994) conclusions and agreed that wolf population viability was enhanced by higher (500 or more wolves) rather than lower population levels (300) and longer (more than 3 years) rather than shorter demonstrated time frames. The USFWS also determined that an essential part of achieving recovery is an equitable distribution of wolf breeding pairs and individual wolves in Idaho, Montana and Wyoming and the three core recovery areas, and concluded that NRM wolf recovery and long-term wolf population viability is dependent on its distribution as well as maintaining the minimum numbers of breeding pairs and wolves.

Minimum recovery goals have been exceeded in the NRM distinct population segment every year since 2002 (U.S. Fish and Wildlife Service et al. 2011). At the time of the most recent wolf population report by the USFWS for the NRM distinct population segment, there were at least 1,704 wolves including 282 packs of which at least 92 met the criteria for breeding pairs in the core states of Idaho, Montana and Wyoming (U.S. Fish and Wildlife Service et al. 2016). When Washington and Oregon wolves were included, there were at least 1,904 wolves, 316 packs and 114 breeding pairs. Although wolf hunting seasons and wolf removals for damage management occur in Idaho, Montana and Wyoming, the wolf populations in these states remain well above thresholds for delisting and the gray wolf population in the western United States continues to expand into new states and regions, with breeding packs now in Washington (Washington Department of Fish and Wildlife et al. 2018), and Oregon and California (Oregon Department of Fish and Wildlife 2018).

Resident packs have saturated much of the suitable habitat in the core recovery areas despite licensed harvest, removals for depredation management and other causes of mortality in Idaho, Montana and Wyoming (Jimenez 2013;2014;2016). There appears to be enough habitat connectivity between occupied wolf habitat in Canada, northwestern Montana, Idaho and the greater Yellowstone area to ensure exchange of sufficient numbers of dispersing wolves to maintain demographic and genetic diversity in the wolf population (Carroll et al. 2006, Oakleaf et al. 2006, von Holdt 2008, von Holdt et al. 2010). Wolf movements between Canada and northwestern Montana have been documented from radio-telemetry monitoring (Pletscher et al. 1991, Pletscher et al. 1997, Boyd and Pletscher 1999, Sime et al. 2007). Wolf movement between Idaho, Montana and Wyoming has been confirmed (71 FR 6634). In addition, USFWS-approved state wolf management plans in Montana (Montana Fish Wildlife and Parks 2003), Idaho (Idaho Legislative Wolf Oversight Committee 2002, Idaho Department of Fish and Game 2008), and an interagency MOU (Wyoming Game and Fish Department et al. 2012) commit to maintaining the metapopulation structure as well as sufficient genetic diversity utilizing various methods including relocation, if necessary, to ensure the long-term viability of the wolf population.

USFWS reviews of the status of the wolf population made in conjunction with delisting indicate that sufficient secure wolf habitat and prey will remain available into the future (76 FR 61782). The vast majority of suitable wolf habitat and the current wolf population are secure in mountainous forested federal public land that will not be legally available for or suitable to intensive human development. The core recovery areas in the NRM have long been recognized as the most likely areas for maintenance of successful metapopulations, with dispersal between subpopulations (71 FR 6634)(U.S. Fish and Wildlife Service 1980;1987;1994, Wyoming Game and Fish Commission 2011). Consequently, human development will not occur on a scale that could possibly affect the overall suitability of Montana for wolves, and no foreseeable habitat-related threats will prevent these areas from supporting a wolf population that is capable of substantially exceeding recovery levels (76 FR 61782).

The USFWS 2015 post-delisting review of the NRM gray wolf population indicated that none of the factors that would trigger a status review had been met and that the NRM wolf population continued to exceed recovery goals (Jimenez and Johnson 2016). Documented dispersal of radio-collared wolves and genetic analysis indicated that the genetic metapopulation structure was being maintained solely through natural dispersal. The USFWS also reviewed potential threats to the population including 1) the presence or threatened destruction, modification or curtailment of its habitat or range; 2) overutilization for commercial, recreational, scientific or educational purposes; 3) disease or predation; 4) inadequacy of existing regulatory mechanisms; and 5) and other natural or man-made factors affecting the continued existence of wolves including (public attitudes, genetic considerations, climate change, catastrophic events and impacts to wolf social structure) and determined that there were no threats to the population that would warrant reconsideration of ESA protections for wolves. The USFWS reached similar conclusions during the reviews for 2012 and 2013 (Middleton et al. 2013, Lendrum et al. 2014) when wolves were delisted and licensed hunting was permitted in Idaho, Montana, and Wyoming.

Gray wolf populations are considered to be stable throughout their range, and they are listed as a species of “least concern” according to the (International Union for Conservation of Nature 2017).

3.5.5.4 Conclusion: Gray Wolves

Given the stable population trend for gray wolves in the state, documented gene flow, and robust recruitment, cumulative impacts on the gray wolf population from all causes, including take by WS-Montana, is not endangering the health of population in Montana or the NRM. Intentional and unintentional take by WS-Montana, would not contribute substantively to existing impacts. Should the status of gray wolves in Montana be changed, WS-Montana will issue a supplement to this EA analyzing the new management strategy.

Table 3.6. Population impact analysis of gray wolf take in Montana, CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional gray wolf take[1]	70	53	37	51	50	**52**	**70**
WS unintentional take[1]	1	0	1	0	0	**0**	**1**
Hunter and Furbearer Harvest[2]	231	213	205	255	233	**227**	**255**
Illegal Harvest[2]	10	10	8	4	1	**7**	**10**
Private citizen PDM[2]	8	7	16	12	15	**12**	**16**
Other Take[2, 3]	18	20	9	13	11	**14**	**20**
Total WS take	71	53	38	51	50	**53**	**71**
Cumulative Take	338	303	276	335	310	**312**	**338**
Estimated Population	931	931	931	931	931	**931**	**931**
WS Take % of Pop.	7.6%	5.7%	4.1%	5.5%	5.4%	**5.6%**	**7.6%**
Cumulative Take % of Pop.	36.3%	32.5%	29.6%	36.0%	33.3%	**33.6%**	**36.3%**
Projected WS Maximum Annual Take	100	gray wolves		10.7%	of population		
Projected Maximum Annual Cumulative Take	401	gray wolves		43.1%	of population		

[1] USDA-WS-APHIS Management Information System.

[2] Personal communications from B. Inman, March 8, 2019.

[3] Other take includes wolves killed by collisions with vehicles and trains, incidental take as a result of capture for monitoring purposes, wolves euthanized, and mortalities identified for which the cause is known (Personal communications from B. Inman, March 8, 2019).

3.5.6 What are the Direct and Cumulative Impacts on Mountain Lion Populations?

3.5.6.1 Mountain Lion Life History Information

Mountain lions, the largest North American feline, have an extensive distribution across western North America, including throughout Montana. However, densities vary across landscapes likely reflecting local distribution of their primary prey (deer and elk), but may also be affected by territorial behaviors. Mountain lions inhabit many habitat types from desert to alpine environments, indicating a wide range of adaptability. Mountain lions in Montana prefer forest cover and edges, moderate slopes, and intermediate elevations. In Montana, mountain lions are opportunistic and adaptable foragers that prey or scavenge on a variety of species (Bauer et al. 2005, Murphy and Ruth 2010) preying on deer and elk (Williams 1992, Murphy 1998, Kunkel et al. 1999, Ruth et al. 2011, Montana Fish Wildlife and Parks 2019b). They may also prey on pets, livestock (Torres et al. 1996), or other wildlife species (Logan and Sweanor 2001) when deer and elk populations decline (Montana Fish Wildlife and Parks 2019b).

Mountain lion density is related closely to prey availability and competitive social interactions for other mountain lions when hunter harvest is not an overriding factor (Pierce et al. 2000, Logan and Sweanor 2001, Stoner et al. 2006). Prey availability is directly related to prey habitat quality, which in turn directly influences mountain lion nutritional health and reproductive and mortality rates. Studies indicate that as available prey increases locally, so do mountain lion densities (Quigley and Hornocker 2010). As mountain lion population density increases, mortality rates from intra-specific fighting and cannibalism also increase, and/or mountain lions disperse into unoccupied or less densely occupied habitat, if available. These relationships of mountain lion to its prey and to other mountain lions are why densities do not reach levels observed in a number of other wildlife species (Oregon Department of Fish and Wildlife 2017). It is also why mountain lions may disperse into atypical mountain lion habitat and cause conflicts there (Bodenchuk and Hayes 2007). Shaw (1981) presented evidence that livestock such as sheep and calves provide a supplemental prey base that supports mountain lions through seasonal declines in their primary prey, in this case deer. This allows an artificially high density to be reached in areas where mountain lion territories overlap with livestock production areas, especially during times of low wild prey availability. Although the relationship of the mountain lion to its prey can help mountain lion populations to increase, intraspecific competition is a greater factor in determining peak density for a particular site. They typically do not reach the high density levels observed in a number of other wildlife species, largely due to social intolerance combined with large home ranges.

Home ranges up to 270mi^2 for females and 320mi^2 for males have been reported (Lindzey 1999, Pierce and Bleich 2003, Armstrong et al. 2011). Variability in home range size between and within sexes is likely a function of social and reproductive status, habitat quantity and quality, and mountain lion population density. Arrangement of home ranges in relation to each other is governed by the mountain lion's mating system, energy requirements, and habitat quality. For females, home range size appears to be based on prey availability for raising young. Male home ranges may be driven primarily by social status and the presence and status of neighboring males (Logan and Sweanor 2000).

Female mountain lions typically breed for the first time between 17 and 24 months of age, but initial breeding may be delayed, especially if the female has not established a territory (Logan and Sweanor 2001). Mountain lions breed and give birth year round but most births occur during late spring and summer (Cougar Management Guidelines Working Group 2005) following a 90-day gestation (Logan and Sweanor 2001). One to six offspring per litter is possible, with an average of two to three young per litter (Easton and Verlander 1977, Ashman et al. 1983, Logan et al. 1986). Young mountain lions become independent of their mother at approximately 15 months of age in Montana (Robinson and DeSimone 2011).

Most males recruited into a population are immigrants, and immigration may constitute as much as 50% of the recruitment into a population (Logan and Sweanor 2000). Males that established an independent territory after dispersal were not adjacent to the natal home range, while 78% of the females that established independent territories after dispersal were adjacent to or overlapped natal home ranges.

3.5.6.2 Mountain Lion Population Information

Mountain lions inhabit many habitat types and are closely associated with deer and elk as primary prey. Historically, mountain lions were distributed throughout Montana except on its open plains and prairies (Young and Goldman 1946). Changes in statutory classifications of mountain lions and their prey have influenced mountain lion populations in Montana (Montana Fish Wildlife and Parks 2019b). After near extirpation by 1930, mountain lion recovery began in the 1950s. In 1971, the state legislature classified mountain lions as a big game species (Montana Fish Wildlife and Parks 2019b). It was not until the mid-1980s that quotas for mountain lion harvest were adopted. By the 1990s, lions expanded their range, legal harvest increased, and human-lion conflicts became increasingly common (Montana Fish Wildlife and Parks 2019b). Today mountain lions occupy all suitable habitat in the state and continue to disperse to neighboring states (Montana Fish Wildlife and Parks 2019b). Mountain lion harvest is reported in 49 of the state's 56 counties (Montana Fish Wildlife and Parks 2019b).

Mountain lions are currently managed by MFWP as a game animal (MCA §87-2-101). The Montana Mountain Lion Monitoring and Management Strategy (MFWP 2019) sets guidelines for Mountain lion management and provides strategies for resolution of human conflicts with mountain lions (Section 1.8.1). These management objectives require maintaining a balance between the biological carrying capacity of the population and social tolerance levels and reinforce MFWP's jurisdiction to manage mountain lion damage on livestock or human/pet health or safety concerns (MCA §87-1-217; Section 2.4.4.1). Furthermore, MCA § 87-6-106 permits landowners to take mountain lions attacking, killing, or threatening to kill a person, livestock, or domestic dogs. Any take under this provision must be reported to MFWP within 72 hours (Section 2.4.4.4). Unlike some other western states, Montana still permits the use of pursuit dogs in mountain lion harvest (MCA § 87-3-127).

Mountain lion density is influenced by prey availability and territoriality behaviors (Seidensticker et al. 1973, Hemker et al. 1984). Territoriality can be an important mortality factor (Maehr 1997, Logan and Sweanor 2001). Estimating population densities for mountain lions is difficult because of the animal's solitary and elusive behavior (Davidson et al. 2014). Additionally, how density is reported varies greatly between studies and it can be difficult to compare findings due to the difference in how they are reported (Quigley and Hornocker 2010, Oregon Department of Fish and Wildlife 2017, Montana Fish Wildlife and Parks 2019b). Mountain lion density estimates range from 0.01/mi^2 to 0.24/mi^2, with an average density estimate for the western states of 0.075/mi2 (Johnson and Strickland 1992). A recent study in western Montana documented mountain lion densities greater than 0.13/mi^2.

Robinson et al. (2015) developed a population estimate for mountain lions in Montana using a combination of resource selection functions, mortality estimation, and dispersal modeling from data collected between 1980 and 2012. This model utilizes extensive data from field-based studies across the western United States and Montana. For example, field-based studies that account for every individual tend to estimate mountain lion densities at 2.6-5.2 adults and/or 5.2-10.4 animals per 100 square miles (Robinson et al. 2015). Survival, especially female survival, and dispersal are primary determinants of mountain lion populations; however, other factors such as habitat quality and prey availability should be incorporated into population models when determining allowable harvest levels. Robinson et al. (2015) combined resource selection functions, mortality estimation, and dispersal modeling to develop a mountain lion population estimate for Montana. Using low starting densities (5.7 per 100 mi^2), low survival estimates, and an assumption of no compensatory response in survival to harvest, the population estimation is considered to be biased low and very conservative. The mountain lion population in Montana in 2005 was estimated to be 3,926 with a possible range of 2,784 and 5,156 mountain lions (Robinson et al. 2015).

Several studies on mountain lion population dynamics provide insights into long-term sustainable harvest levels. Robinette et al. (1977) reported a sustained annual mortality of 32% in Utah, while Ashman et al. (1983) noted a sustained annual mortality of at least 30% in Nevada. Ashman et al. (1983) believed that under "moderate to heavy exploitation (30% to 50%)" mountain lion populations in their study area had the recruitment (reproduction and immigration) capability to rapidly replace annual losses. Logan et al. (1996) determined the average annual rate of increase in adult mountain lions in a New Mexico study varied between 5-17% during a 7-year period in an unexploited population that followed 4 years of intensive mountain lion management to 21-28% in a population where harvest and management was simulated by removing half of the lions from the study area. They concluded that rates of increase in mountain lion populations are density dependent, meaning that, as a population declines in relation to carrying capacity, the rate of increase becomes greater. This is a natural mechanism of wildlife populations in general that serves to protect species by enhancing the ability of populations to recover from declines.

Logan et al. (1996) suggested that for a mountain lion population to remain at or near the maximum supported by the habitat (the carrying capacity), no more than 11% of the adults should be harvested per year. However, Logan's study was based on a relatively isolated population in the San Andres Mountains, leaving little opportunity for immigration.

An important distinction to be made is that the mountain lion population in Montana is not isolated and un-hunted, but mountain lions are currently widely distributed in Montana (Montana Fish Wildlife and Parks 2019b), which provides opportunities for immigration.

In Montana, mountain lion populations are well distributed throughout the state with many opportunities for immigration (Montana Fish Wildlife and Parks 2019b). State wildlife agencies will sometimes allow a greater percentage of mountain lions to be harvested in order to reach management goals. MFWP intensively manages mountain lion populations and makes decisions about annual harvest rates (Montana Fish Wildlife and Parks 2019b). MFWP may decide to decrease the mountain lion population when it determines the population to be too high in a specific area. Such population management is accomplished through hunting regulations. For example, Montana has designated some Lion Management Units (LMUs) "Special Management Areas" where unlimited quotas or very high quotas that are rarely met serve to reduce human-mountain lion conflict or to respond to low social tolerance. Such "Special Management Areas" exist immediately surrounding Kalispell (LMU 170) and the highly developed Missoula Valley (Missoula Special Management Area) (Montana Fish Wildlife and Parks 2019b). This can ease social and political concerns (Jenks et al. 2011). MFWP has objectives to "conserve mountain lions as a functional and valued part of Montana's wildland ecosystems…and to maintain a balance between mountain lion populations, their prey, and humans by helping direct local harvest of mountain lions…" (Montana Fish Wildlife and Parks 2019b). WS-Montana's role in mountain lion management in the state is limited to assisting with human-lion conflicts, particularly threats to livestock and pets (Montana Fish Wildlife and Parks 2019b).

3.5.6.3 Mountain Lion Population Impact Analysis

3.5.6.3.1 WS-Montana Direct Effects on Mountain Lions

WS-Montana received increasing numbers of requests for assistance with mountain lion-livestock conflicts after October 2017 when the Montana Livestock Loss Board began offering compensation for livestock losses that were confirmed to be caused by or probably caused by mountain lions. During FY2013 – FY2017, mountain lions were responsible for 4.5% of the livestock losses recorded by WS-Montana, and 4.5% of the value of all losses due to predators (Table 1.6). During FY 2018, which began as compensation for mountain lion losses became available, livestock losses to mountain lions accounted for 6.9% of total losses and 5.2% of the total value of losses. The value of livestock losses from mountain lions averaged $55,730 per year during FY2013 – FY2017 (Table 1.6). Mountain lions made up 0.21% of the annual average of WS-Montana predator take from FY2013 - FY2017. Mountain lions are generally taken by foothold traps (61%), firearms (17%), and neck snares (22%) (Table 2.1; Table E.1). Mountain lion take by WS during this period has mainly been on private land (94%; Table 2.2) with the remaining take occurring on tribal lands (Table 2.2).

While the impact analyses for the majority of species in this EA use data from the federal fiscal year, which most closely overlaps the hunting and trapping seasons, mountain lion harvest and mortality data is presented by MFWP per calendar year (CY). Therefore, mountain lion impact analyses will be presented by calendar year.

In response to requests for assistance with mountain lion damage, WS-Montana intentionally removed an average of 15 mountain lions each year between CY2013 and CY2017 (Table 3.7). WS-Montana did not unintentionally remove any mountain lions during the same period (Table 3.7); however, 2 mountain lions were unintentionally captured and released (1 in 2013 and 1 in 2014). WS-Montana total take ranged from 11 to 21 mountain lions annually between CY2013 – CY2017. This corresponds to an average of 0.4% of the estimated mountain lion population and 0.5% and 0.3% of the low and high range, respectively, of the same population estimate (Section 3.5.6.2 and MFWP 2019). Maximum take by WS-Montana, which occurred in 2016, was 0.5%, of the estimated mountain lion population in Montana and 0.8% and 0.4% of the low and high range, respectively, of the same population estimate (Table 3.7).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future mountain lion removals for IPDM would be similar to take during the last five years. Under Alternative 1, we anticipate that WS-Montana would take no more than 50 mountain lions. This corresponds to 1.3% of the estimated statewide mountain lion population and 1.8% and 1.0% of the low and high range, respectively, of the same population estimate (Appendix E). This is well below the thresholds for maximum sustainable harvest discussed above which ranged from 11-50% (Section 3.5.6.2). Local populations of mountain lions may temporarily be affected. For example, in "Special Management Areas" where mountain lion populations may already be depleted; however, immigration will likely counteract this effect (Montana Fish Wildlife and Parks 2019b) and, long-term, populations would not be affected. Under Alternative 1, we anticipate that WS-Montana IPDM would have a negligible impact on mountain lion populations locally or statewide.

3.5.6.3.2 Indirect Impacts

It has been suggested that increased mountain lion harvest may lead to increased infanticide (Cooley et al. 2009, Ruth et al. 2011). In support of this supposition, cub survival has been shown to be higher with increased density of adult male mountain lions (Ruth et al. 2011). Also, infanticide mostly occurs in winter when the territories of resident males and immigrating males overlap (Ruth et al. 2011). However, recent mountain lion research in Colorado has shown higher infanticide rates during a 5-year non-hunting period than the subsequent 5-year hunting phase of the study (Logan 2015). Also, infanticide from male lions was the main cause of death for cubs in the absence of sport hunting (Logan 2014). Increased harvest of male lions has also been suggested to lead to increased sub-adult males in the population, and subsequently, increased changes in territory (Logan and Sweanor 2009). Due to their low densities, high dispersal rates, long dispersal distances, and social intolerance, we do not anticipate any impact on immigration rates, dispersal distances, fecundity, or age structure due to IPDM conducted by WS-Montana.

3.5.6.3.3 Cumulative Mortality

One of the goals of the MFWP Mountain Lion Monitoring and Management Strategy (Montana Fish Wildlife and Parks 2019b) is to "conserve mountain lions as a functional part of Montana's wildland ecosystems." This goal includes protecting mountain lions and their habitats, as well as addressing conflicts between mountain lions, livestock, and human/pet safety (Section 1.11.5) and will be implemented through adaptive harvest management (Montana Fish Wildlife and Parks 2019b). All WS-Montana take of mountain lions is reportable to MFWP as part of this adaptive strategy. Cumulative take of mountain lions in Montana is attributable to several sources (Table 3.7).

Mountain lion take from recreational harvest peaked in the mid-1990s in Montana. This period of historically high harvest was followed by a decline in harvest-age structure and a reduction in quotas in the 2000s. After this time hunting regulations became increasingly complex and MFWP and the Fish and Wildlife Commission worked to balance hunter opportunity for residents and non-residents, limit conflict among hunters, and reduce conflicts with livestock and growing suburban communities

(Section 3.5.6.2 and (Montana Fish Wildlife and Parks 2019b)). Quotas on male and female harvest assist MFWP in conserving healthy populations across the 4 mountain lion ecoregions in the state (Montana Fish Wildlife and Parks 2019b).

Hunters harvested an average of 491 mountain lions annually in Montana with a range of 467 to 516 during 2013-2017 (Table 3.7). MFWP took an average of 14 for protection of human health and safety or in response to damage, and an additional 10 mountain lions were unintentionally removed by MFWP on average (Table 3.7). An average of 22 mountain lions per year were reported to MFWP killed by vehicle collisions and animals found dead, and MFWP is aware of an additional 6 mountain lions killed illegally on average each year (Table 3.7). As all take of mountain lions must be reported to MFWP, this is assumed to be a close estimate of total non-WS-Montana take.

The average cumulative take of mountain lions in Montana is 559 per year which corresponds to 14.2% of the population estimate and 20.1% and 10.8% of the low and high range of the population estimate, respectively (Table 3.7). The largest cumulative take was 611 mountain lions per year, approximately 15.6% of the total estimated population and 21.9% and 11.9% of the low and high range of the population estimate, respectively (Table 3.7), with WS-Montana contributing 0.5% of the cumulative amount, relative to the annual maximum sustainable harvest of that ranges between 11 and 50% (Table 3.7).

If WS-Montana were to take the WS annual maximum take of 50 mountain lions, the projected cumulative take would be approximately 16.7% of the estimated population, with WS-Montana contributing 1.3% to the cumulative amount (See table 3.7 for take as a proportion of the low and high range of the population estimate).

MFWP has committed to periodic monitoring of mountain lion abundance in 3 of the 4 mountain lion ecoregions in the state (Montana Fish Wildlife and Parks 2019b). This monitoring will be used to improve accuracy of a recently developed the Montana Mountain Lion Integrated Population Model, which will be used to evaluate the impacts of harvest and cumulative take on the population (Nowak et al. 2018) and implement Montana's adaptive harvest management (Montana Fish Wildlife and Parks 2019b).

3.5.6.4 Conclusion: Mountain Lion

Given the range of annual maximum sustainable harvest level (11%-50%), WS-Montana concludes that the cumulative impact of all recorded mountain lion mortality in Montana, including intentional and unintentional take by WS-Montana, would not adversely impact the size or sustainability of the Montana mountain lion population. Should an increase in requests for assistance with mountain lion result in the projected annual WS maximum take, cumulative impacts on the statewide mountain lion population would still be expected to remain low relative to the annual maximum sustainable harvest level in a population with immigration. MFWP continues to monitor harvest and population trends and has created an adaptive harvest management strategy to ensure mountain lions are conserved (Montana Fish Wildlife and Parks 2019b). At this time WS-Montana IPDM program does significantly impact the mountain lion population.

Table 3.7. Population impact analysis of mountain lion take in Montana, CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional mountain lion take[1]	14	16	13	21	11	**15**	**21**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
MFWP intentional take[2]	22	9	9	30	2	**14**	**30**
MFWP unintentional take[2]	16	12	13	6	4	**10**	**16**
Hunter and Furbearer Harvest[3]	519	476	467	495	496	**491**	**519**
Illegal Harvest[2]	9	8	4	3	7	**6**	**10**
Other Take[2]	31	24	19	20	17	**22**	**31**
Total WS take	14	16	13	21	11	**15**	**78**
Cumulative Take	611	545	525	575	537	**559**	**611**
Estimated Population	3,926 (2,784-5,156)	3,926 (2,784-5,156)	3,926 (2,784-5,156)	3,926 (2,784-5,156)	3,926 (2,784-5,156)	**3,926 (2,784-5,156)**	**3,926 (2,784-5,156)**
WS Take % of Pop.	0.4% (0.5%-0.3%)	0.4% (0.6%-0.3%)	0.3% (0.5%-0.3%)	0.5% (0.8%-0.4%)	0.3% (0.4%-0.2%)	**0.4% (0.5%-0.3%)**	**0.5% (0.8%-0.4%)**
Cumulative Take % of Pop.	15.6% (21.9%-11.9%)	13.9% (19.6%-10.6%)	13.4% (18.9%-10.2%)	14.6% (20.7%-11.2%)	13.7% (19.3%-10.4%)	**14.2% (20.1%-10.8%)**	**15.6% (21.9%-11.9%)**
Projected WS Maximum Annual Take	50 mountain lions			1.3% (1.8%-1.0%) of population			
Projected Maximum Annual Cumulative Take	656 mountain lions			16.7% (23.6%-12.7%) of population			

[1] USDA-WS-APHIS Management Information System.

[2] Unpublished data through personal communications with MFWP, B. Inman, 8/20/2018. Other take typically represents road killed mountain lions.

[3] Represents the number of animals taken during recreational harvest seasons (https://myfwp.mt.gov/fwpPub/harvestReports).

3.5.7 What are the Direct and Cumulative Impacts on Striped Skunk Populations?

3.5.7.1 Striped Skunk Life History Information

The striped skunk is the most common member of the Mephitidae family, with distributions throughout southern Canada, United States, and northern Mexico. They are generally considered abundant throughout their range and have increased their geographical range in North America with extensive clearing of forests. They are not associated with any well-defined habitat type (Rosatte 1987), but are capable of living in a variety of environments including woodland, plains and streamside thickets, rock piles, old buildings, agricultural lands and urban areas. Striped skunks are often found in association with farmland and urban areas, whereas the other skunks are mostly associated with grasslands and rocky areas, such as in canyons and outcrops (Rosatte 1987).

The diet of striped skunks includes insects, earthworms, beehives, birds, eggs, small mammals, and carrion (Wade-Smith and Verts 1982, Vickery et al. 1992, Larivière and Messier 1997a). Striped skunks often are nocturnal (Larivière and Messier 1997b). The seasonal availability of prey species can cause seasonal changes in habitat preference for the striped skunk (Crabtree and Wolfe 1988, Crabtree et al. 1989).

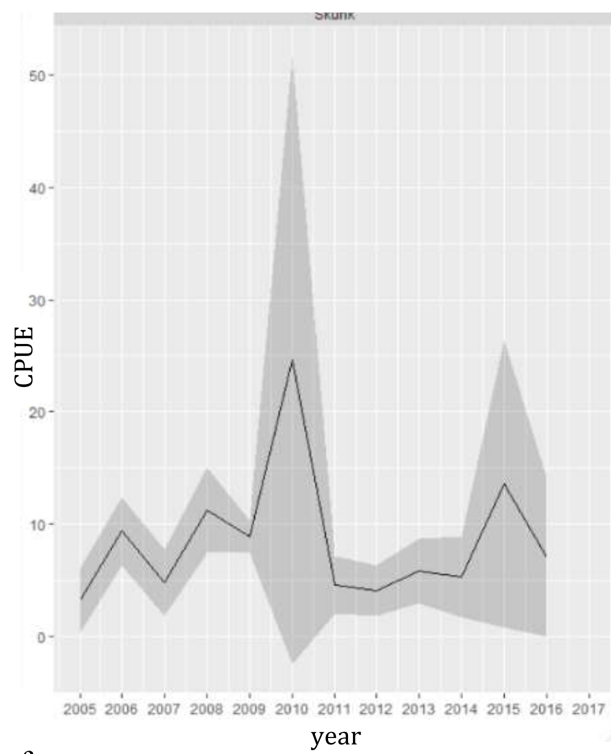
The home range of striped skunks is not sharply defined over space and time, but is altered based on seasonal requirements, such as raising young, winter denning, feeding activities, and dispersal (Rosatte 1987). Home ranges have been reported between 0.073 mi^2 and 1.98 mi^2 for striped skunks in rural areas (Houseknecht 1971, Storm 1972, Bjorge et al. 1981, Rosatte and Gunson 1984, Bixler and Gittleman 2000).

Striped skunks breed from late January through March (Verts 1967) and produce one litter of 2-10 young between April and June (Maser et al. 1981). Both males and females are sexually mature at 10 months (Wade-Smith and Verts 1982). Winter severity, lack of winter denning sites, disease, and human-caused mortality greatly impact striped skunk populations (Larivière and Messier 1998, Hansen et al. 2004, Gehrt 2005). Skunks primarily cause odor problems around homes, can transmit diseases, such as rabies and leptospirosis (Hass and Dragoo 2006), to humans and domestic animals, and sometimes prey on poultry and eggs.

3.5.7.2 Striped Skunk Population Information

Striped skunks are classified by MCA §87-2-101 as a predatory animal in Montana, and as such may be taken year-round for any reason without a requirement to report take. MFWP does not track or attempt to estimate population levels or densities. Voluntary trapper harvest survey data provides catch per unit effort (CPUE), which is considered to be an indicator of relative population trend (Giddings 2014). CPUE suggests a relatively stable population (Figure 3.5, personal communications, David Messmer, MFWP, 7/25/2019).

Figure 3.5 Catch per unit effort for striped skunk in Montana



Striped skunk densities can be highly variable depending on habitat quality, with densities reported in the literature range from 0.26 to 67/mi^2 (Ferris and Andrews 1967, Verts 1967, Lynch 1972, Bjorge et al. 1981, Broadfoot et al. 2001, Hansen et al. 2004). Additionally, California Department of Fish and Game (1995) calculated striped skunk densities to be between 1.3 and 6.20/mi^2. Many factors may contribute to the widely differing population densities, including type of habitat, food availability, disease, season of the year and geographic area (Storm and Tzilkowski 1982). Specific population density estimates for striped skunks in Montana are not available because, although managed by MFWP, their population is not directly monitored. For purposes of this analysis, we will conservatively estimate skunk densities at 0.26/mi^2 throughout Montana, for an estimated population of about 38,220 animals. The annual maximum sustainable harvest for striped skunk is estimated at 60% of the population (Boddicker 1980; Table 3.4); however, this rate may be based only on experience, rather than on empirical data. We know of no other published sustainable harvest rate for striped skunks. Due to the uncertainty of the validity of the (Boddicker 1980) harvest threshold, we will use the lowest reported threshold among all of the mesocarnivore species analyzed, which is 10%, as a conservative estimate.

3.5.7.3 Striped Skunk Population Impact Analysis

3.5.7.3.1 WS-Montana Direct Effects on Striped Skunks

Requests for WS-Montana to assist with striped skunks causing damage are relatively few. Most requests for assistance involve conflicts involve domestic fowl, concerns of disease transmission to livestock, and threats to aircraft and airport personnel safety. WS-Montana intentionally removed an average of 9.4 striped skunks per year between FY2013 and FY2017, and WS-Montana unintentionally removed an average of 2.8 striped skunks per year during the analysis period (Table 3.8). This corresponds to an annual average of 0.03% of the population (Table 3.8). Striped skunks are primarily taken with foothold traps (72%) or neck snares (26%) on a combination of county/city lands, which are typically airports (57%), and private lands (43%) (Tables 2.1 and 2.2; Table E.1).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future striped skunk removals for IPDM would be similar to take during the last five years and would not exceed 50 striped skunks (Appendix E). This corresponds to an annual average of 0.1% of the statewide population (Table 3.8) well under the maximum sustainable harvest of 10%. This level of take would be expected to have a negligible impact on striped skunks locally, and no impact on the statewide striped skunk population.

3.5.7.3.2 Indirect Impacts

Striped skunk take by WS-Montana is largely limited to airport properties and private agricultural lands, so the potential indirect impacts are limited to those areas. It is possible that within these areas, WS-Montana IPDM might alter the rate of immigration, which might affect the age structure. Because these areas are already so dramatically influenced by humans, particularly airports, we do not consider these impacts to be significant to the natural environment. We are not aware of any other significant indirect impacts to striped skunks due to IPDM conducted by WS-Montana.

3.5.7.3.3 Cumulative Mortality

Striped skunk take by various entities contributes to cumulative take in Montana (Table 3.8). Unknown and unreported mortality cannot be calculated for striped skunks; however WS-Montana has used maximum take projections and a very conservative population estimate to consider potential impacts. MFWP reports that furbearer harvest removed an average of 1,359 striped skunks per year from FY2013 - FY2017, while an average of 9.4 striped skunks were taken by WS-Montana in response to damage (Table 3.8). The average annual cumulative take of striped skunks is 1,371 per year. The highest statewide known cumulative take was 1,699 striped skunks per year, approximately 4.4% of the total estimated population. WS-Montana contributed 0.07% of the cumulative amount (Table 3.8), relative to the annual maximum sustainable harvest of 10%. If WS-Montana were to take the annual maximum take of 50 striped skunks, the projected cumulative take would be approximately 4.5% of the population, with WS-Montana contributing 0.1% to the cumulative amount.

As in the coyote and red fox analyses above, it is likely that some number of striped skunks are taken annually without our knowledge, including those taken by private citizens for PDM which are not reported. However, this number is likely to be very small compared to furbearer harvest. Moreover, due to the large disparity between cumulative take and sustainable take, the inclusion of this take (if it were known) would not affect our analysis.

Striped skunk populations are considered to be stable throughout their range, and they are listed as a species of "least concern" according to the (International Union for Conservation of Nature 2017).

3.5.7.4 Conclusion: Striped Skunks

Given the stable population trend for striped skunks in the state, the low unintentional take, and an annual maximum sustainable harvest level between 10% and 60%, cumulative impacts on the striped skunk population from all causes, including take by WS-Montana, is not adversely impacting the population. Should an increase in requests for assistance with striped skunks result in the projected annual WS-Montana maximum take, cumulative impacts on the statewide striped skunk population would still be expected to remain low relative to the annual maximum sustainable harvest level. Given the low proportion of cumulative take, and even lower WS-Montana take, direct and cumulative impacts from take would not adversely impact the size or sustainability of the Montana striped skunk population.

Table 3.8. Population impact analysis of striped skunk take in Montana, FY2013 - FY2017.

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional striped skunk take[1]	15	19	8	3	2	**9.4**	**19**
WS unintentional take[1]	10	1	1	1	1	**2.8**	**10**
Furbearer Harvest[2]	1,554	1,635	1,670	1,497	440	**1,359**	**1,670**
Total WS take	25	20	9	4	3	**12.2**	**25**
Cumulative Take	1,579	1,655	1,679	1,501	443	**1,371**	**1,699**
Estimated Population	38,220	38,220	38,220	38,220	38,220	**38,220**	**38,220**
WS Take % of Pop.	0.07%	0.05%	0.02%	0.01%	0.01%	**0.03%**	**0.07%**
Cumulative Take % of Pop.	4.1%	4.3%	4.4%	3.9%	1.2%	**3.6%**	**4.4%**
Projected WS Maximum Annual Take	50 striped skunk			0.1% of population			

Projected Maximum Annual Cumulative Take	1,720 striped skunk	4.5% of population

[1] USDA-WS-APHIS Management Information System.
[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).

3.5.8 What are the Direct and Cumulative Impacts on Black Bear Populations?

3.5.8.1 Black Bear Life History Information

Black bears are distributed throughout much of the U.S., Canada, and Mexico. Black bear populations are stable or increasing across most of their range, with an estimated 750,000 to 918,000 black bears in North America (Hristienko and McDonald Jr. 2007, Herrero et al. 2011). Black bears occur in all MFWP administrative regions of Montana (Mace and Chilton-Radant 2011). Distribution is closely associated with coniferous forest habitats within the various mountain ranges in the state; however, black bears may occur in the intermountain valleys of the more southern portions of the state. These valleys are used to travel to preferred habitats, and at times bears may be attracted to both natural and unnatural food sources on private lands in these low elevation areas.

Black bears are relatively long-lived, occasionally reaching 20 years of age or more in the wild (Keay 1995, Aune and Anderon 2003), and eat a variety of foods including grass, fruits, nuts, carrion, livestock, mammals, insects, bees (especially the larva) and garbage. Invertebrates also provide a consistent source of protein for bears throughout the year (Bull and Heater 2001). In areas near human dwellings, bears may be attracted to garbage, bird feeders, gardens, orchards, livestock and livestock feeds, and beehives as food sources. Diets of black bears change seasonally and are based on food availability (Kolenosky and Strathearn 1987). When available, bears will catch and consume deer fawns and elk calves, and feed on carrion (Bull and Heater 2001, Larivière 2001). Research indicates they may also be a more efficient predator of large game and livestock than was previously believed (Rayl et al. 2015, Leblond et al. 2016). Managing human-bear interactions is multifaceted and there are many methods for decreasing conflict (Lackey et al. 2018).

Black bears are usually sexually mature at 3.5 years of age, but some females may not breed until 4.5 years (Graber 1981, Kohn 1982). Mating generally occurs in June and July, egg implantation is delayed until late November to early December, and gestation is generally 60 to 70 days (Foresman and Daniel 1983, Eiler et al. 1989, Hellgren et al. 1991). Litter size ranges from one to four; in comparison to black bears in the eastern U.S., black bears in the western U.S. generally have a smaller litters and a later mean first age to reproduction (Kasworm and Thier 1994). An average litter size of 2.08 cubs/litter and an average reproductive interval of 2.2 years were estimated from harvested female black bears in Montana (Mace and Chilton-Radant 2011). Lactating females usually do not breed, which explains alternate year pregnancies (LeCount 1983, Hellgren et al. 1991). Cubs stay with the females 16 to 18 months after birth, typically leaving in late spring prior to the breeding season.

There are few natural predators of adult black bears, but young bears may be killed by mountain lions, bobcats, and coyotes, or by other adult black bears (Larivière 2001).

Juvenile black bear annual mortality ranges between 20 and 70 percent, with orphaned cubs having the highest mortality (Kolenosky and Strathearn 1987). Natural mortality in adult black bears is approximately 10-20 percent per year (Fraser et al. 1982). The primary sources of mortality for adult black bears in Montana are harvest by hunters and, to a much lesser degree, removal because of damage and safety concerns (Mace and Chilton-Radant 2011). Other less common causes include vehicle and train collisions, illegal take, and accidental injury requiring euthanasia (Mace and Chilton-Radant 2011).

3.5.8.2 Black Bear Population Information

Montana designated black bears as a big game animal in 1923 (MCA §87-2-101) with the protection of regulated hunting seasons. Hunting with dogs was banned as was shooting bears lured to bait (Dickson 2009). A person may kill a black bear if it is attacking, killing, or threatening to kill a person or livestock (MCA §87-6-106; Section 2.4.4.1). The take must be reported to MFWP within 72 hours and the carcass must be surrendered to MFWP (MCA §87-6-106, Section 2.4.4.5). Livestock owners or their agents or employees of MFWP or WS-Montana may use dogs to pursue stock-killing black bears (MCA §87-3-127).

MFWP has management authority of black bears in Montana. The MOU between MFWP and WS-Montana allows WS-Montana to work under the authority of MFWP to capture black bears causing damage to livestock including bees and beehives. The MOU states that MFWP will make decisions regarding where, when, and how many black bears will be subject to lethal control by WS-Montana. Under the terms of this MOU, MFWP is responsible for handling non-livestock complaints involving black bears. WS-Montana reports all take of depredating black bears, including the hunt district they were removed from, within 48 hours to MFWP to help them determine population impacts from these activities.

Since the mid-1990s, Montana's annual black bear harvest averaged 4th in the nation behind Washington, Oregon, and Idaho in numbers of bears harvested (Mace and Chilton-Radant 2011). Concerns about the high harvest resulted in a study to determine harvest rates and define the maximum sustainable harvest in Montana. The study found stable trends in harvest and relatively low female harvest, which suggest a stable population. Current harvest levels are relatively consistent from year to year (Table 3.3), suggesting that the black bear population in Montana continues to be stable.

Mace and Chilton-Radant (2011) estimated the black bear population at 13,307 bears with bear density greatest in the moist, coniferous habitats of northwestern Montana and generally lowest in less moist habitats towards the south. The mean density of 12.5 bears/100 km^2 and the 116,554 km^2 of black bear habitat in Montana (Mace and Chilton-Radant 2011) predict that there would be 14,569 bears in the state. For analyzing potential impacts, the more conservative population estimate of 13,307 will be used.

The allowable harvest level cited for black bears has been estimated at 20% of the overall mortality rate of the population (California Department of Fish and Game 2001). Clark and Smith (1994) estimated sustainable yield of 26% for a location in Arkansas with good bear habitat, though they noted that this level may not be able to be maintained indefinitely. Other published rates have been as low as 14.2-15.9% based on models (Miller 1990). Mace and Chilton-Radant (2011) reported that black bears in Montana returned to a sustainable population at a mortality rate of approximately 16% when they estimated the reproductive rate of 0.945 and a mean age of first reproduction of six years. The most conservative estimate of sustainable harvest from literature (14%) will be used to analyze potential impacts.

3.5.8.3 Black Bear Population Impact Analysis

3.5.8.3.1 WS-Montana Direct Effects on Black Bears

Black bears caused 7.2% of livestock losses due to predators among damages reported to WS-Montana during FY2013 – FY 2017 (Table 1.6). Damages from black bears was mostly to livestock ($313,015 annually including beehives), but also included human health & safety, crops, feed, and structures. Most bears are taken on private land (98%; Table 2.2), and mostly with snares (41%), firearms (37%), and culvert traps (22%; Table 2.1; Table E.1).

In response to requests for assistance with black bear damage from FY2013 – FY2017, WS-Montana intentionally removed an average of 9.8 bears each year (Table 3.9). The year with the highest WS-Montana intentional take during this timeframe was FY2013, with 14 black bears taken. Unintentional take did not result in any mortalities, all bears unintentionally captured were freed (an annual average of 2 between FY2013 – FY2017 with a high of 4 in FY2015). This corresponds to an average of 0.07%, with a maximum of 0.11% of the statewide black bear population (Table 3.9). Under Alternative 1, we anticipate a possible increase in black bear take by WS-Montana, up to 50 black bears, due to possible increasing conflicts with bears. This corresponds to 0.38% of the estimated statewide black bear population. This level of black bear take is well below the 14% sustainable harvest threshold and is expected to have no impact on statewide black bear populations. Impacts to most local black bear populations would be negligible.

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future bear removals for IPDM will be similar to take during the last five years except for years with mast crop failure. Black bears often subsidize their diets with anthropogenic food sources when mast crops failure occurs (Noyce and Garshelis 1997, Ditmer et al. 2015). Therefore, under Alternative 1 (current activity level with fluctuations in the level of assistance), the projected WS-Montana annual maximum take would be 50 black bears (Appendix E). Some local black bear populations might be temporarily decreased due to WS-Montana IPDM. Such decreases would be localized and temporary and would not impact the statewide black bear population. In the absence of these actions by WS-Montana, the bears would likely still be removed either by state agencies, agricultural producers or their agents.

3.5.8.3.2 Indirect Impacts

In rural areas and on the private land where the majority of WS-Montana black bear operational assistance occurs, the conflict between black bears and livestock producers will likely vary annually depending on availability of natural foods. Even in poor mast years, when WS-Montana black bear take is expected to be higher, the anticipated maximum take (0.38% of the population) would not be expected to result in any significant impacts to black bear immigration rates, fecundity, or age structure at local or statewide population levels. We are not aware of any other indirect impacts to black bear due to WS-Montana PDM.

3.5.8.3.3 Cumulative Mortality

Various sources of black bear removals contribute to the cumulative take of bears in Montana (Table 3.9). Hunters harvested an average of 1,469 black bears per year (or about 11% of the most conservative population estimate). An average of 16 black bears were taken per year during 2013 through 2017 for damage to agriculture and property and human health and safety concerns by sources other than WS-Montana. Additionally, an average of 8 bears per year were removed illegally (Table 3.9).

Cumulative take ranged from 1,408 to 1,677, with an average of 1,503 per year (Table 3.9), representing a close estimate of total take given bear take reporting requirements. This corresponds to an average of 11.3%, with a maximum of 12.6% of the estimated black bear population in Montana with WS-Montana contributing 0.07% to 0.11% of the cumulative amount. Under Alternative 1, we anticipate cumulative take not to exceed 1,800 black bears in any year with WS-Montana's take not exceeding 50 bears in any year. These 1,800 black bears correspond to 13.5% of the estimated black bear population in Montana. This level of harvest is well below the 16% sustainable harvest threshold. These levels of cumulative take are expected to have a negligible impact on most local black bear populations. We anticipate no impact to the statewide black bear population under Alternative 1.

Black bear populations are considered to be increasing throughout their range, and are listed as a species of "least concern" according to the International Union for Conservation of Nature (2017).

3.5.8.4 Conclusion: Black Bears

Given the stable population trend for black bears in the state, the low unintentional take, and an annual maximum sustainable harvest level of 14%, cumulative impacts on the black bear population from all causes, including take by WS-Montana, is not adversely impacting the population.

Therefore, WS-Montana concludes that the cumulative impact of all recorded black bear mortality in Montana, including intentional and unintentional take by WS-Montana, is not adversely impacting the size or sustainability of the Montana black bear population. In addition, MFWP monitors cumulative impacts through management objectives and hunt quotas to ensure the health and sustainability of the black bear population (Mace and Chilton-Radant 2011); therefore, WS-Montana's impact on the population has a built-in measure to assure that WS-Montana does not have an adverse cumulative impact on the population.

Should an increase in requests for assistance with black bear damage result in the projected annual WS maximum take, cumulative impacts on the statewide black bear population would still be expected to remain low relative to the annual maximum sustainable harvest level. Given the low proportion of cumulative take, and even lower WS-Montana take, direct and cumulative impacts from take would not adversely impact the size or sustainability of the black bear population.

Table 3.9. Population impact analysis of black bear take in Montana, FY2013 - FY2017

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional lethal black bear take[1]	14	11	13	5	6	**9.8**	**14**
WS intentional transfer of custody[1]	0	0	0	2	0	**0.4**	**2**
WS unintentional capture and release[1]	2	3	4	1	1	**2.2**	**4**
Hunter Harvest[2]	1,379	1,406	1,619	1,550	1,392	**1,469**	**1,619**
MFWP management take[2]	13	9	35	15	5	**15.4**	**35**
USFWS management take[2]	2	0	0	1	0	**0.6**	**2**
Illegal take[2]	0	6	10	9	15	**8**	**15**
Other take[2]	39	29	72	59	33	**46.4**	**72**
Total WS lethal take	14	11	13	5	6	**9.8**	**14**
Cumulative Lethal Take	1,447	1,461	1,749	1,639	1,451	**1,549**	**1,757**
Estimated Population	13,307	13,307	13,307	13,307	13,307	**13,307**	**13,307**
WS Take % of Pop.	0.11%	0.08%	0.10%	0.04%	0.05%	**0.07%**	**0.11%**
Cumulative Take % of Pop.	10.9%	11.0%	13.1%	12.3%	10.9%	**11.6%**	**13.1%**
Projected WS Maximum Annual Take	**50**	**black bears**			**0.3%**	**of population**	
Projected Maximum Annual Cumulative Take	**1,783**	**black bears**			**13.4%**	**of population**	

[1] USDA-WS-APHIS Management Information System.

[2] Unpublished data through personal communications with MFWP, B. Inman, 8/20/2018. Other take typically represents bears killed by vehicles or other identified mortalities with unknown causes.

3.5.9 What are the Direct and Cumulative Impacts on Badger Populations?

3.5.9.1 Badger Life History Information

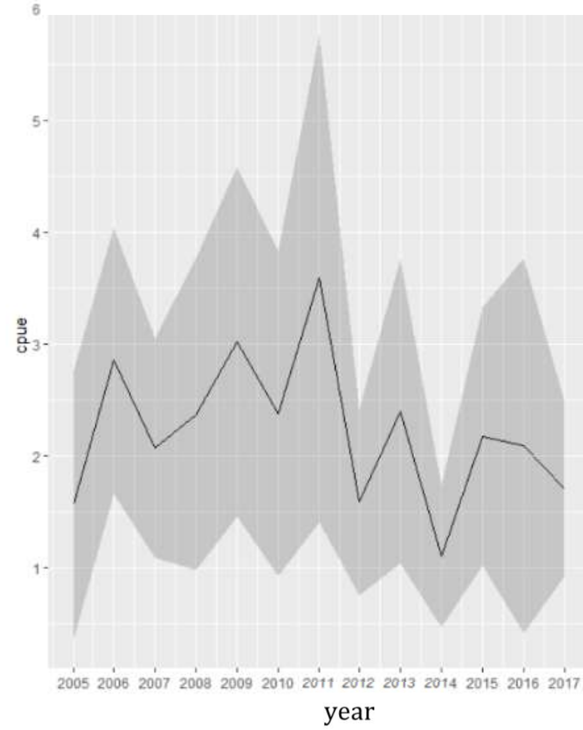
Badgers are found throughout most of the western U.S. In Montana, badgers are found in plain, desert, foothill, and mountain meadow habitats at moderate densities. Their distribution is commonly associated with fossorial (below ground) prey such as prairie dogs (*Cynomys spp*.) and ground squirrels (*Spermophilus*, *Otospermophilus*, and *Ictidomys*). Home range sizes of adult badgers averaged 0.6 and 0.9 mi^2 for females and males in Idaho (Messick and Hornocker 1981) and ranged from 0.5 to 2.4 mi^2 in Utah (Lindzey 1978).

Badgers breed in late summer, with implantation delayed until February and the birth of one to five cubs in March or April. Family groups begin to break up in mid-summer. Females with a litter frequently remain near the den sites. Badgers are mostly nocturnal, opportunistically feeding on burrowing animals, rodents, birds, reptiles, and insects.

3.5.9.2 Badger Population Information

Badgers are classified as a nongame animal by MFWP (MCA §87-2-101 and §87-5-102), and as such may be taken year-round for any reason without a requirement to report take. MFWP does not track or attempt to estimate Badger population levels or densities. Voluntary trapper harvest survey data provides catch per unit effort (CPUE), which is considered to be an indicator of relative population trend (Giddings 2014). CPUE suggests a stable to slightly declining population (Figure 3.6, personal communications, David Messmer, MFWP, 7/25/2019); however, population in the state is sufficiently abundant that they are managed as a nongame species with no limits on harvest/take. At any time, the state could adjust the regulations on this species if they felt population declines merit additional protection.

Figure 3.6. Catch per unit effort for badgers in Montana



It has been estimated that the Curlew Valley on the Utah-Idaho border supported 1 badger/mi^2 (Lindzey 1971). Messick and Hornocker (1981) found 13/mi^2 in southwestern Idaho and noted that densities may be higher during periods when juveniles are dispersing. A study by Hein and Andelt (1995) in Colorado estimated a minimum population density of 0.7 badgers/mi^2 by comparing scent-station visitations, spotlight surveys, headlight surveys, road mortality, and a trapping index. Clark and Andrews (1982) found a higher density of 4.74 badgers/mi^2 in New Mexico, Colorado, and Utah. Densities of 5 badgers/mi^2 were recorded in the National Elk Refuge in northwestern Wyoming (Lindzey 2003). The lowest density estimate from the literature of 0.7 badgers/mi^2 was applied to generate a conservative statewide population estimate of 102,900 badgers.

Annual maximum sustainable harvest for badger populations has been estimated at 30 to 40% (Boddicker 1980). These rates may be based only on experience, and not on any empirical data, so they may not be accurate. Banci and Proulx (1999) reported the sustainable harvest rate to be between 10% and 25% in Canada, including areas of recent badger range expansion. The sustainable harvest rate is likely to be higher in more established populations, such as in Montana, but we are not aware of any other published sustainable harvest rates for badgers.

3.5.9.3 Badger Population Impact Analysis

3.5.9.3.1 WS-Montana Direct Effects on Badgers

Requests for WS-Montana to assist with damage causing damage are relatively few. Most requests for assistance involve conflicts involve damage to pastures and associated threats to cattle and threats to aircraft safety. WS-Montana intentionally removed an average of 7.8 badgers each year between FY2013 and FY2017, and WS-Montana unintentionally removed an average of 0.8 badgers per year during the analysis period (Table 3.10). This corresponds to an annual average of 0.01% of the population (Table 3.10). Badgers are primarily taken with neck snares (77%) or foothold traps (20%) on county/city lands, which are typically airports (69%) or private lands (31%) (Tables 2.1 and 2.2; Table E.1).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future badger removals for IPDM would be similar to take during the last five years and would not exceed 30 badgers (Appendix E). This corresponds to an annual average of 0.03% of the statewide population (Table 3.10), well under the maximum sustainable harvest range of 10% to 40%. This level of take would be expected to have a negligible impact on badgers locally, except at airports where wildlife are excluded, and no impact on the statewide badger population.

3.5.9.3.2 Indirect Effects

We considered potential impacts due to increased immigration rates and distances, and increased fecundity, potentially resulting in changes in local population age structure. However, due to the negligibly low numbers of badgers expected to be taken (up to 0.03% of the conservatively estimated population), we do not expect any significant indirect impacts to badgers due to IPDM conducted by WS-Montana.

3.5.9.3.3 Cumulative Mortality

Various sources of badger removals contribute to the cumulative take of badgers in Montana. Unknown and unreported mortality cannot be calculated for badgers; however WS-Montana has used maximum take projections and a very conservative population estimate to consider potential impacts.

Badger harvest reported to MFWP through voluntary trapper surveys averaged 767 per year between FY2013 and FY2017, while an average of 8.6 badgers were taken by WS-Montana in total (Table 3.10). The average annual cumulative take of badgers is 776 per year. The highest statewide known cumulative take was 1,050 badgers per year, approximately 1% of the total estimated population. WS-Montana contributed 0.01% of the cumulative amount (Table 3.10) relative to the annual maximum sustainable harvest of 10% to 40%. If WS-Montana were to take the estimated annual maximum take of 30 badgers, the projected cumulative take would be approximately 1% of the population, with WS-Montana contributing 0.03% to the cumulative amount.

As in the coyote, red fox, and skunk analyses above, it is likely that some number of badgers are taken annually without our knowledge, including those taken by private citizens for PDM which are not reported. However, this number is likely to be very small compared to furbearer harvest. Moreover, due to the large disparity between cumulative take and sustainable take, the inclusion of this take (if it were known) would not affect our analysis.

Throughout their range, American badger populations are considered to be decreasing, but they are listed as a species of "least concern" according to the International Union for Conservation of Nature (2017).

3.5.9.4 Conclusion: Badgers

Given the annual maximum sustainable harvest rate between 10% and 40%, cumulative impacts on the badger population from all causes, including take by WS-Montana, remain relatively small (0.8% on average). Despite a possible declining population in the state indicated by CPUE, the population is sufficiently abundant that badgers are

managed as a nongame species with no limits on harvest/take. At any time, the state could adjust the regulations on this species if they felt population declines merit additional protection.

Should an increase in requests for assistance with badgers result in the projected annual WS maximum take, cumulative impacts on the statewide badger population would still be expected to remain low relative to the annual maximum sustainable harvest level. Given the low proportion of cumulative take, and even lower WS-Montana take, direct and cumulative impacts from take would not adversely impact the size or sustainability of the Montana badger population.

Table 3.10. **Population impact analysis of badger take in Montana, FY2013 - FY2017.**

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional badger take[1]	9	6	14	9	1	**7.8**	**14**
WS unintentional take[1]	0	2	1	1	0	**0.8**	**2**
Furbearer Harvest[2]	1,034	691	659	591	862	**767**	**1,034**
Total WS take	9	8	15	10	1	**8.6**	**15**
Cumulative Take	1,043	699	674	601	863	**776**	**1,043**
Estimated Population	102,900	102,900	102,900	102,900	102,900	**102,900**	**102,900**
WS Take % of Pop.	0.01%	0.01%	0.01%	0.01%	0.00%	**0.01%**	**0.01%**
Cumulative Take % of Pop.	1.0%	0.7%	0.7%	0.6%	0.8%	**0.8%**	**1.0%**
Projected WS Maximum Annual Take	30 badgers			0.03% of population			
Projected Maximum Annual Cumulative Take	1,064 badgers			1.0% of population			

[1] USDA-APHIS-WS Management Information System.

[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).

3.5.10 What are the Direct and Cumulative Impacts on Raccoon Populations?

3.5.10.1 Raccoon Life History Information

Raccoons are highly adaptable and abundant throughout North America, except northern Canada. Since the 1940s, raccoon populations throughout the U.S. have increased, likely as a result of adapting well to man-made habitats; like coyotes and red fox, raccoons are ecological generalists. They are typically associated with riparian and forested habitats, and in Montana also prairie wetlands (Kaufmann 1982), but have become increasingly common in urban areas with the high diversity of habitats and abundant human food sources (Armstrong et al. 2011).

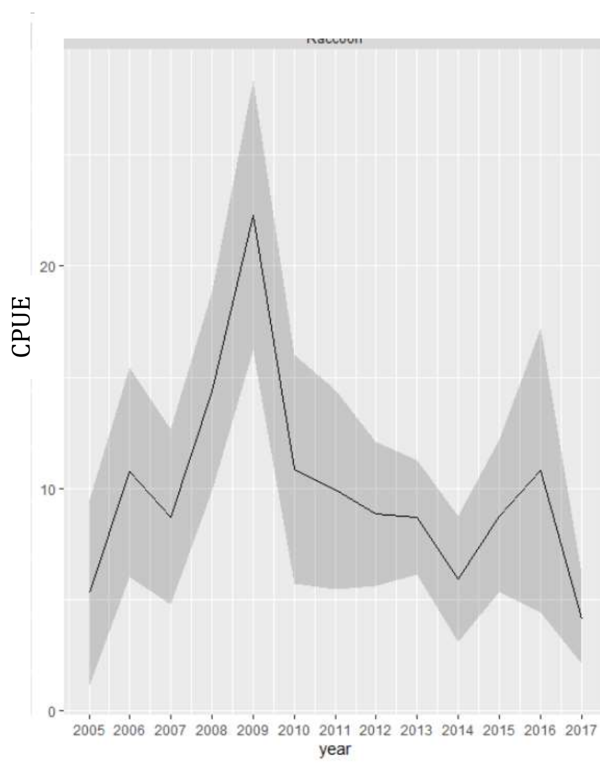
Raccoons are omnivorous, and feed on carrion, garbage, birds, mammals, insects, crayfish, mussels, other invertebrates, a wide variety of grains, various fruits, other plant materials, and most or all foods prepared for human or animal consumption, including pet food (Sanderson 1987).

Raccoon population densities vary considerably, depending on food availability and habitat suitability, and populations can vary widely between seasons and years due to disease, harvest, and natural mortality (Gehrt 2003). Generally, 60% of females breed their first year, while 90% breed after their first year. Females have one litter per year with two to four young per litter. The majority of litters are born in May. The young may stay with the females for the first year (Kaufmann 1982).

3.5.10.2 Raccoon Population Information

Raccoons are classified as a nongame animal by MFWP (MCA §87-2-101 and §87-5-102), and as such may be taken year-round for any reason without a requirement to report take. MFWP does not track or attempt to estimate raccoon population levels or densities. MFWP raccoon population monitoring activities are based on voluntary trapper harvest survey data (Giddings 2014). Catch per unit effort (CPUE), an indicator of relative population trend (Giddings 2014), suggests a slightly declining population (Figure 3.7, personal communications, David Messmer, MFWP, 7/25/2019). The raccoon population in the state is still sufficiently abundant that they are managed as a nongame species with no limits on harvest/take. At any time, the state could adjust the regulations on this species if they felt population declines merit additional protection.

Figure 3.7. Catch per unit effort for raccoons in Montana



Raccoons generally do well in human-altered areas due to human food subsidies, and the highest densities usually occur in urban/suburban areas. Typical rural densities run from 1 to 70 raccoons per square mile (Gehrt 2003). Beasley and Rhodes (2012) found raccoon densities of 3.37 to 117.07/mi^2 in northcentral Indiana forest patches. Urban densities in northeastern Illinois can range from 64.8 to 225.3/mi^2, with an average of 121.7/mi^2 (Prange et al. 2003, Gehrt 2004).

In order to estimate raccoon population densities in Montana for this EA, we use the lowest density from the literature of one raccoon/mi^2. Using this density, the conservative population estimate of 147,000 raccoons occurs in Montana.

Sanderson (1987) reported sustainable harvest rates of 49%, 53%, and 59% for raccoon populations with low, medium, and high fecundity, respectively. For this analysis, we will use the lowest reported harvest rate (49%) as a conservative estimate.

3.5.10.3 Raccoon Population Impact Analysis

3.5.10.3.1 WS-Montana Direct Effects on Raccoons

Raccoon damage problems involve predation on domestic fowl or lambs, damage to crops, and human health and safety concerns, especially in and near residences and airports. In response to requests for assistance with raccoon damage, WS-Montana intentionally removed an average of 4.6 raccoons per year (Table 3.11). WS-Montana unintentionally removed an average of 0.4 raccoons per year during the analysis period. Combined intentional and unintentional take accounts for 0.003% of the estimated population. Most raccoons are taken on private lands or city and county land (approximately 83% and 17%, respectively; Table 2.2). Raccoons are primarily taken with neck snares (Table 2.1, Table E.1).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future raccoon removals for IPDM would be similar to take during the last five years. Total annual take by WS-Montana ranged from 1 to 10 raccoons. Therefore, under Alternative 1 (current activity level with fluctuations in the level of assistance), the projected WS-Montana annual maximum take would be 50 raccoons or 0.03% of the estimated population in the state (Table 3.11, Appendix E), which is well under the conservative estimate of the maximum sustainable harvest of 49% (Sanderson 1987).

3.5.10.3.2 Indirect Effects

Raccoon take by WS-Montana is largely limited to airports and lambing sheds, so the potential indirect impacts are limited to those areas. We considered potential impacts due to increased immigration rates and distances, and increased fecundity, potentially resulting in changes in local population age structure. However, due to the negligibly low numbers of raccoons expected to be taken (up to 0.003% of the estimated population) and the heavily human impacted environments where raccoon take occurs, we do not expect any significant indirect impacts to raccoons due to IPDM conducted by WS-Montana.

3.5.10.3.3 Cumulative Mortality on Raccoons

Various sources of raccoon removals contribute to the cumulative take of raccoons in Montana (Table 3.11). During FY2013 through FY2017, an estimated annual average of 4,175 raccoons were reported taken by trappers. Additional sources of anthropogenic mortality likely include unreported take by landowners to resolve damage and unreported take by hunters and trappers.

The average annual cumulative take of raccoon is 4,180 per year. The largest cumulative take was 6,567 raccoons per year, approximately 4.5% of the total estimated population, with WS-Montana contributing 0.007% of the cumulative amount (Table 3.11). If WS-Montana were to take the annual maximum take of 50 raccoons, the projected cumulative take would be approximately 4.5% of the population, with WS-Montana contributing 0.03% to the cumulative amount.

As in the coyote, red fox, skunk, and badger analyses above, it is likely that some number of raccoons are taken annually without our knowledge, including those taken by private citizens for PDM which are not reported. However, this number is likely to be very small compared to furbearer harvest. Moreover, due to the large disparity between cumulative take and sustainable take, the inclusion of this take (if it were known) would not affect our analysis.

Raccoon populations are considered to be increasing throughout their range, and they are listed as a species of "least concern" according to the International Union for Conservation of Nature (2017).

3.5.10.4 Conclusion: Raccoon

Given the annual maximum sustainable harvest level of 49%, WS-Montana concludes that the cumulative impact of all recorded raccoon mortality in Montana, including intentional and unintentional take by WS-Montana, would not adversely impact the size or sustainability of the Montana raccoon population. Should an increase in requests for assistance with raccoons result in the projected annual WS maximum take, cumulative impacts on the statewide raccoon population would still be expected to remain low relative to the annual maximum sustainable harvest level. We anticipate this level of take to have a negligible impact on raccoons locally, and no impact on the statewide raccoon populations in Montana. While there may have been a decrease in the state's raccoon population, year to year variation in wildlife populations is normal. MFWP continues to monitor harvest and population trends and has not changed raccoon harvest regulations, which do not limit harvest. At this time, the WS-Montana IPDM program does significantly impact the raccoon population.

Table 3. 11. Population impact analysis of raccoon take in Montana, FY2013 - FY2017.

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional raccoon take[1]	5	4	8	5	1	**4.6**	**8**
WS unintentional take[1]	0	0	2	0	0	**0.4**	**2**
Furbearer Harvest[2]	6,557	6,001	3,073	2,856	2,386	**4,175**	**6,557**
Total WS take	5	4	10	5	1	**5**	**10**
Cumulative Take	6,562	6,005	3,083	2,861	2,387	**4,180**	**6,562**

Estimated Population	147,000	147,000	147,000	147,000	147,000	**147,000**	**147,000**
WS Take % of Pop.	0.003%	0.003%	0.007%	0.003%	0.001%	**0.003%**	**0.007%**
Cumulative Take % of Pop.	4.5%	4.1%	2.1%	1.9%	1.6%	**2.8%**	**4.5%**

Projected WS Maximum Annual Take	50 raccoons	0.03% of population
Projected Maximum Annual Cumulative Take	6,607 raccoons	4.5% of population

[1] USDA-WS-APHIS Management Information System.
[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).

3.5.11 What are the Direct and Cumulative Impacts on Grizzly Bear Populations?

3.5.11.1 Grizzly Bear Life History Information

The grizzly bear (*Ursus arctos horribilis*) is one of two subspecies of the brown bear (*Ursus arctos*) which occupy North America. Historically, the grizzly bear ranged from the Great Plains to the Pacific Ocean and from Alaska to Mexico. Today, the grizzly bear is found in only about 6% of its original range in the lower 48 states presently occupying only parts Montana, Idaho, Wyoming, and Washington (Haroldson et al. In press) (Haroldson et el In Press). It was listed as threatened south of Canada in July of 1975.

Grizzly bears have great metabolic demands requiring extensive home ranges. Home range sizes varies from 50 square miles to a few hundred square miles, and the home ranges of adult grizzly bears frequently overlap. Most areas currently inhabited by the species are represented by contiguous, relatively undisturbed mountainous habitat exhibiting high topographic and vegetative diversity (Wilson 2012).

The grizzly bear is an opportunistic feeder that uses a wide variety of plant and animal food sources (Interagency Grizzly Bear Study Team 2013). The grizzly bear diet varies seasonally and yearly depending on the availability of high-quality foods. In spring, grasses, sedges, roots, moss, and bulbs are primary food sources. During summer and early autumn, berries are essential, and bulbs and tubers are also eaten. Individuals sometimes travel hundreds of miles during the autumn to reach areas of favorable food supplies, such as areas of high berry production (U.S. Fish and Wildlife Service 1993). Gunther et al. (2014) conducted a review of grizzly bear studies in the Greater Yellowstone Ecosystem and found grizzly bears have been documented to consume 175 plant, 37 invertebrate, 34 mammal, 7 fungi, 7 bird, 4 fish, 1 amphibian, and 1 algae species. Gunther et al. (2014) also reported the most frequently detected items in grizzly bear diets in their study area were graminoids, ants, whitebark pine seeds (*Pinus albicaulis*), clover (*Trifolium* spp.), and dandelion (*Taraxacum* spp.). On a temporal basis the most consistently used foods were graminoids, ants, whitebark pine seeds, clover, elk, thistle (*Cirsium* spp.), and horsetail (*Equisetum* spp.). Spawning fish and army cutworm moths (*Euxoa auxiliaries*) are important food sources where they are abundant. Grizzly bears also consume whitebark pine seeds contained in red squirrel (*Tamiasciurus hudsonicus*) cone caches (Mattson et al. 2001). Grizzly bears intensify their caloric intake in the 2-4 preceding winter. During this period of hyperphagia grizzly bears can gain up to 3 pounds per day, and their focus on food can lead to conflicts with humans.

During years with poor food production, many grizzlies move out of secure habitat to elevations/areas where they are more likely to come into conflict with people, livestock, and property. For example, studies have shown that during poor whitebark pine seed years grizzly bears selected less for whitebark pine stands (Costello et al. 2014) and consumed more animal matter, boosting their fat levels to match those measured in years of high cone production (Schwartz et al. 2014). With this shift in habitat use studies have documented an increase in human-grizzly bear conflicts (Mattson et al. 2001). During such times, human-caused grizzly bear deaths are more than four times higher than in good food years. Livestock operators are also more likely to suffer losses from bear depredation with losses primarily involving sheep and young cattle (Dood et al. 2006). Although livestock and grizzly bears share many landscapes in Montana, conflicts with livestock result in few grizzly bear mortalities.

Grizzly bears are normally crepuscular and can be active at night in certain situations. Hibernation can vary between 5 to 7 months. They have excellent hearing and smell. They may attack without apparent provocation. Except for females with cubs, grizzly bears are normally solitary, active animals. Every third year, females produce one to four young (usually two). A sow is protective of her offspring and will attack if she thinks she or her cubs are threatened.

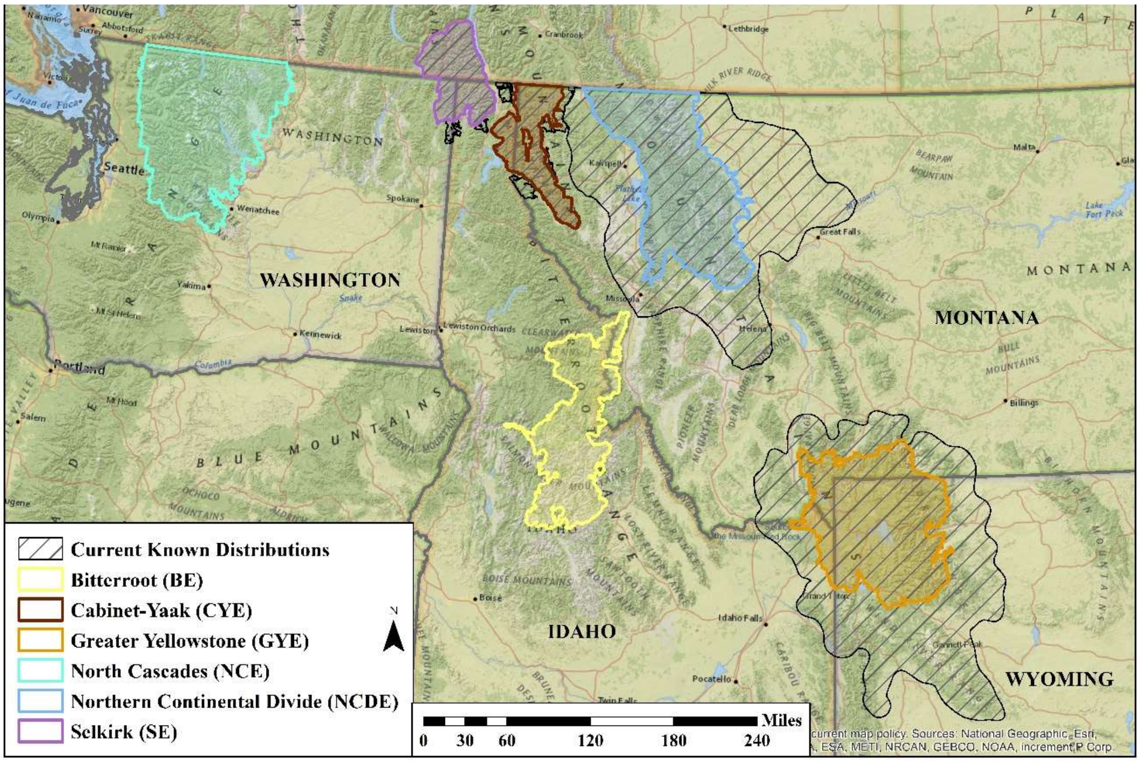
3.5.11.2 Grizzly Bear Population Information

In 1975 grizzly bears were listed as "threatened" in the lower 48 states under the ESA (U.S. Fish and Wildlife Service 1975). The USFWS, in cooperation with MFWP, the USFS, National Parks Service (NPS), BLM, Blackfeet Tribe, and Confederated Salish and Kootenai tribes, currently manages grizzly bears in Montana as "threatened" under authority of the ESA and plan for and foresee a secure and recovered population of grizzly bears in Montana. This cooperative management is under the Interagency Grizzly Bear Committee (IGBC) within which all affected agencies and tribes are partners. As a way of expressing the State's ongoing commitment to ensuring the continued expansion and recovery of the species, MFWP prepared two grizzly bear management plans and final programmatic EISs, one for western Montana and another for the GYE, (Dood et al. 2006, Montana Fish Wildlife and Parks 2013). These plans analyze the State's activities in recovering grizzly bears. Moreover, MFWP recognizes that successful recovery of grizzly bears requires an integrated approach that balances and incorporates the biological requirements of the bear within a broader social, economic, and political framework. In April 2019, Montana Governor Steve Bullock called for the creation of a diverse, citizen-led Grizzly Bear Advisory Council (GBAC) to address increasing management challenges and conflicts as grizzly bear population continue to expand in Montana. WS-Montana is a part of the support staff providing information to the council.

MFWP established a proactive collaborative working agreement with WS-Montana that focuses programs and efforts on conflict prevention where possible. In 2018, WS-Montana hired two employees to focus on conflict prevention. One works with livestock producers to protect livestock from grizzly depredations by building electric fences. The other works as a range rider in far northwest Montana protecting livestock from grizzly bears. In 2020, WS-Montana hired a second conflict prevention specialist to protect livestock from depredations by building electric fences, as well as a second range rider to protect livestock on grazing allotments in southwestern Montana. Under the MOU between MFWP and WS-Montana, issues of livestock depredation by grizzly bears are jointly investigated by WS-Montana and MFWP when possible. While WS-Montana is authorized to solely investigate issues of property damage, MFWP deals with human safety incidents and nuisance bears. This relationship was planned for and analyzed in MFWP's management plans for grizzly bears in southwestern and western Montana (Dood et al. 2006, Montana Fish Wildlife and Parks 2013). WS-Montana works under a subpermit authorizing take from the USFWS (letter from H. Cooley, USFWS, to J. Steuber, WS-Montana, dated March 22, 2018) and works closely with MFWP to coordinate all PDM with USFWS prior to actions being taken.

The Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1993) identified 6 recovery zones, 4 of which are partially or completely within Montana. If grizzly bears are delisted, the recovery zones will be referred to as the Primary Conservation Area (PCA) to reflect the shift from managing for recovery to managing for conservation, (U.S. Fish and Wildlife Service 2016a), which is defined as the area in each grizzly bear ecosystem within which the population and habitat criteria for achievement of recovery will be measured. Areas outside of the recovery zone may provide habitat that grizzly bears will use but are not considered necessary for the survival and recovery of this species. Grizzly bear habitat immediately outside the recovery zones but within a buffer area specific for each recovery zone is managed as a demographic monitoring area (DMA), recognizing that population and mortality data within this zone are pertinent to recovery criteria (U.S. Fish and Wildlife Service 1993). Beyond the DMA, where conflicts and mortality are expected to be higher, grizzly bear mortalities are not considered when determining whether recovery goals have been met; however, protection is still accorded to grizzly bears under the ESA (Wilson 2012).

Figure 3.8. Grizzly bear recovery zones and distribution (found at https://www.fws.gov/mountain-prairie/es/grizzlybear.php)



Estimated distributions are current as of 2018 for the GYE and the NCDE and are current as of 2017 for the CYE and the SE. The distribution for the NCE is currently unknown and a draft EIS was released in early 2017 to examine recovery options. The BE is currently unoccupied with a reintroduction proposal and a non-essential experimental population status.

The 4 recovery zones within Montana are the Northern Continental Divide Ecosystem (NCDE), located entirely within Montana, and the Greater Yellowstone Ecosystem (GYE), Cabinet-Yaak Ecosystem (CYE), and Bitterroot Ecosystem (BE) located partially within Montana (Figure 3.8). The BE does not currently support a documented grizzly bear population (U.S. Fish and Wildlife Service 2000), but it is identified as suitable habitat and grizzly bear sightings have been reported in recent years. Currently, the NCDE, GYE, and CYE are occupied, and grizzly bears are expanding their ranges outside of the NCDE and GYE (Figure 3.8). Grizzly bears within the NCDE and GYE have reached biological recovery goals (U.S. Fish and Wildlife Service 1993;2016b). The grizzly bear population in the NCDE has recently been estimated at 960 bears in 2014 (Costello et al. 2016) and 1,047 grizzly bears in 2018 (Committee 2018). The population in the NCDE is increasing at a rate of 2.3% growth per year (Costello et al. 2016), and grizzly bears are moving east of the Rocky Mountain front into prairie habitat where conflicts with agriculture are more likely. There are an estimated 718 grizzly bears in the GYE (van Manen et al. 2018). While the population estimate and growth for the GYE has remained relatively stable within the DMA (White et al. 2017), the number of conflicts occurring at the periphery of the GYE is increasing (van Manen et al. 2017). This indicates that while some areas in the GYE may be at carrying capacity (White et al.

2017), the population distribution is expanding. The CYE is currently occupied by a minimum of 54 grizzly bears (Kasworm 2019).

Each recovery zone is managed by a separate subcommittee of the IGBC which is composed of land managers, state wildlife agencies, tribes, and county representatives for the area covered by that recovery zone. For example, the 9,209-square mile GYE recovery zone includes portions of Wyoming, Montana, and Idaho, portions of five National Forests (Beaverhead-Deer Lodge, Bridger-Teton, Custer-Gallatin, Shoshone, and Caribou- Targhee), Yellowstone and Grand Teton National Parks, portions of adjacent private and state lands, and lands managed by the BLM (Wilson 2012). In northwestern Montana, the NCDE includes about 9,600 square miles including Glacier National Park, parts of the Flathead and Blackfeet Reservations, parts of five national forests, BLM, and state and private lands. The CYE in northwestern Montana and northeastern Idaho has more than 2,609 square miles of forested and mountainous habitat (U.S. Fish and Wildlife Service 1993).

The USFWS first proposed delisting of grizzly bears in the GYE in 2005 (70 FR 69854). Following this proposed action, grizzly bears were delisted in the GYE in 2007. This decision was vacated by the District Court of Montana in 2009. In 2017 the USFWS again proposed delisting of grizzly bears in the GYE (U.S. Fish and Wildlife Service 2016b). After the USFWS delisted the grizzly bear, the decision to delist was again vacated in a 2018 court decision. In preparation for the proposed delisting of grizzly bears in the GYE, the IGBC Yellowstone Ecosystem Subcommittee prepared the 2016 Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Ecosystem to manage bears in the event of delisting (Committee 2016). Also in preparation for delisting, the NCDE subcommittee of the IGBC prepared a Conservation Strategy for the NCDE Grizzly Bear (Committee 2018). Because the decision to delist grizzly bears in the GYE was again vacated by the courts, the USFWS is not moving forward with delisting of grizzly bears in the NCDE until a legally defensibly strategy for delisting can be identified, which may include revising the Conservation Strategies. For these reasons, we will not analyze impacts of WS-Montana actions within the context of these conservation strategies in this EA. Any future delisting of grizzly bears will require a supplement to this EA.

Mortalities of grizzly bears inside the DMAs of the NCDE and GYE, and the CYE recovery zone and 10-mile buffer, are limited by the USFWS (U.S. Fish and Wildlife Service 1975;1993, Kasworm et al. 2015, Costello et al. 2016, U.S. Fish and Wildlife Service 2016a;2017a), and mortality limits are set as a percentage of population size. Mortalities of grizzly bears outside the DMAs and recovery zones (plus buffer zones) are monitored and limited by the USFWS, however mortality thresholds are not set, because there is no population information from which to calculate mortality rates (U.S. Fish and Wildlife Service 1993). In the NCDE and CYE, grizzly bear human-caused mortalities are limited to 4% of the estimated population size. This mortality limit is set below the estimated maximum sustainable harvest level of 6% (Harris 1985) to allow for population growth. Mortality limits set for the GYE are scaled according to population size (Figure 3.9) to achieve the population goal inside the DMA of 674 bears (U.S. Fish and Wildlife Service 2017a). The GYE is currently estimated at 714 bears (van Manen et al. 2019). Therefore, the current mortality limits are 9% for independent females (that are at least 2 years old), 9% for dependent young, and 20% for independent males. While total mortality limits are set according to the regulations above, take is managed according to the guidelines set in the original listing (U.S. Fish and Wildlife Service 1975), which states, "Grizzly bears in the 48 conterminous States may not be taken except in defense of human life, or to remove demonstrable but "non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises...In addition, takings to remove demonstrable but non-immediate threats to human safety, or to prevent significant depredations on livestock lawfully on the premises, can be performed only by Federal or State employees, and only after reasonable efforts to live-capture and release unharmed in a remote area the bear involved have failed." The USFWS currently approves agency removal, one of the many causes of grizzly bear mortality, on a case-by-case basis ensuring that the total number of mortalities remains under the limit.

All sources of mortality are tracked at the recovery zone level (C. Costello personal communications September 15 and 29, 2018, www.usgs.gov/science/interagency-grizzly-bear-study-team , (Costello et al. 2016, Kasworm et al. 2018b, van Manen et al. 2018). Grizzly bear numbers and population trends are not estimated on a statewide level. Population estimates for grizzly bears inside each recovery zone and buffer zone are estimated. These cannot be summed to estimate a statewide population because significant portions of the DMA of the GYE lie outside of Montana in Wyoming and Idaho. In addition, a statewide population estimate is not possible because we do not have estimates for numbers of grizzly bears outside of the GYE and NCDE DMAs and the CYE recovery zone plus 10 mile buffer. We present WS-Montana take in the context of total take inside the DMAs and recovery zone plus 10 mile buffer (Table 3.13) and analyze cumulative impacts on the grizzly bear population within the DMAs of each recovery zone (Tables 3.14, 3.15, and 3.16).

Table 3.12. Mortality limits inside the DMA for the GYE are based on population size (USFWS 2016).

	Total Grizzly Bear Population Estimate			
	<600*	**600-674**	**675-747**	**>747**
Mortality limit for independent females	0%	<7.6%	9%	10%
Mortality limit for independent males	0%	15%	20%	22%
Mortality limit for dependent young	0%	<7.6%	9%	10%

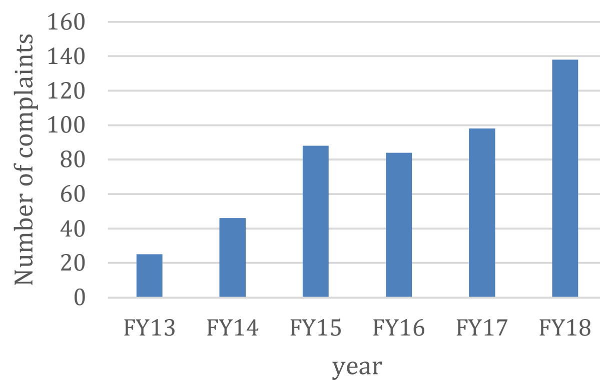
*For populations less than 600, there will be no discretionary mortality except as necessary for human safety.

3.5.11.3 Grizzly Bear Population Impact Analysis

3.5.11.3.1 WS-Montana Direct Effects on Grizzly Bear

WS-Montana continues to receive increasing numbers of requests for assistance with grizzly bear conflicts (Figure 3.9). During FY2013 – FY2017, grizzly bears were responsible for 4.3% of the livestock losses recorded by WS-Montana and 11.4% of the value of all losses due to predators (MIS 2018). The value of livestock losses from grizzly bears totaled $701,325 between FY2013 and FY 2017 (Table 1.6). Grizzly bears made up 0.01% of WS-Montana lethal predator take from FY2013 - FY2017 (Table 2.2).

Figure 3.9. Number of grizzly bear complaints received by WS-Montana (MIS 2018)



While the impact analyses for the majority of species in this EA use data from the federal fiscal year, which most closely overlaps the hunting and trapping seasons, grizzly bear mortality data is presented in IGBC publications per calendar year (CY). Therefore, for grizzly bear population impact analyses, we will present WS-Montana take per calendar year.

In response to requests for assistance with grizzly bear damage between CY2013 and CY2017, WS-Montana intentionally removed an average of 0.8 grizzly bears per year (Table 3.13). WS-Montana did not unintentionally remove any grizzly bears during the analysis period (Table 3.13), however, in August 2019 a grizzly bear was unintentionally captured during gray wolf PDM. The grizzly bear was subsequently released unharmed. WS-Montana total take ranged from 0 to 2 bears annually between CY2013 – CY2017. In 2015, WS-Montana removed one grizzly bear from the GYE. This bear was removed after MFWP relocated the bear because it killed more than 25 cattle in Carbon County. Shortly, after being relocated, it returned to Carbon County and immediately began killing livestock again. In 2016, WS-Montana removed 1 bear from the NCDE east of the Rocky Mountain front. In 2017, WS-Montana removed 2 bears. One bear was removed from the CYE, and another was removed in the GYE (MIS 2018). WS-Montana's lethal removal of grizzly bears between CY2013-CY2017 occurred by aerial shooting (75%) and foot snares (25%) (Table 2.1; Table E.1) with all take during the period FY2013-FY2017 on private land (Table 2.2).

WS-Montana also captures grizzly bears for damage management purposes when requested by MFWP. MFWP requests assistance to capture grizzly bears for 4 purposes; to relocate, to euthanize, to release on site, or to radio collar. The fate of the animal and relocation sites are determined by the USFWS Recovery Plan (1993) and the 4(d) Rule (50 CFR 17.40), IGBC guidelines, MFWP, USFS, the Blackfeet Nations, CSKT, and Glacier National Park. WS-Montana and MFWP do not have the authority alone to make a determination as to the fate of the animal. In many cases where WS-Montana assistance is requested, WS-Montana transfers custody of the grizzly bear to MFWP and is unaware of the fate of that animal. Often times the decision to relocate or euthanize is made 24 or more hours after custody has been transferred. Between CY2013 – CY2017 WS, Montana transferred custody of an average of 7 bears annually to MFWP (Table 3.12). The number of bears that were captured by WS-Montana and transferred to MFWP varied annually between 2 and 12 (Table 3.13). WS-Montana captured and freed or radio collared an average of 0.8 bears annually between CY2013 – CY2017 (Table 3.13) with the number ranging from 0-2 bears annually. Of the 39 grizzly bears that were transferred to MFWP, freed, or radio-collared between CY2013 – CY2017, 69% were captured with foot snares, 26% with culvert traps, and 5% were chemically immobilized from a helicopter (MIS 2018). The majority of these captures occurred on private lands (92%) with the remainder occurring on the U.S. national forests (8%) (MIS 2018).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected requests for assistance, WS-Montana expects that future grizzly bear removals for IPDM would be similar to take during the last five years. Under Alternative 1, we anticipate that WS-Montana would take no more than 21 grizzly bears annually within DMAs in Montana. The projected WS maximum annual take allows flexibility in which agency removes grizzly bears causing damage. In the event MFWP could not respond to conflicts and remove grizzly bears, WS-Montana would be able to increase grizzly take while remaining below mortality thresholds. Any lethal removal would remain well under the mortality limits set for each population because the USFWS would authorize all removals. Under Alternative 1, we anticipate that WS-Montana IPDM would have a negligible impact on grizzly populations locally or statewide due to regulated oversight provided by the USFWS.

Table 3.13. Population impact analysis of grizzly bear take inside DMAs in Montana, CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional grizzly bear lethal take[1]	0	0	1	1	2	**0.8**	**2**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
WS transfer of custody to MFWP[1]	2	8	12	5	8	**7.0**	**12**
WS captured and freed/radio collared[1]	0	0	0	2	2	**0.8**	**2**
MFWP/USFWS lethal take[2]	9	6	12	7	9	8.6	12
Illegal Harvest[3]	10	8	4	4	5	6.2	10
Total WS lethal take	0	0	1	1	2	**0.8**	**2**
Cumulative lethal take	19	14	17	12	16	**15.6**	**19**
WS take as a percentage of cumulative take	0.0%	0.0%	5.9%	8.3%	12.5%	**5.3%**	**12.5%**
Projected WS Maximum Annual Lethal Take	21 Grizzly bears						
Projected Maximum Annual Cumulative Take	45 Grizzly bears						

[1] USDA-WS-APHIS Management Information System.

[2] MFWP/USFWS lethal take indicates non-WS management removals in the NCDE (C. Costello, personal communication, 8/15/2018) and GYE (https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-

science_center_objects=4#qt-science_center_objects). For the GYE, management removals occurring in Montana or within YNP were included as portions of YNP occur within Montana. No non-WS management removals occurred in the CYE (W. Kasworm, personal communication, 10/9/2019).

[3] Known illegal harvest of grizzly bears occurred in the NCDE (C. Costello, personal communications, 8/29/2018). It is likely that grizzly bears in the GYE were also harvested illegally. These are likely reported as "under investigation" in the GYE mortalitiy database (https://www.usgs.gov/science/interagency-grizzly-bear-study-team?qt-science_center_objects=4#qt-science_center_objects), thus could not be identified for use in this analysis.

3.5.11.3.2 Indirect Effects

We considered whether lethal removal of grizzly bears by WS-Montana may have indirect impacts that may include a reduction in the rate of range expansion, an increase in the number of generations that learn to feed on livestock, and increased social tolerance for grizzly bears.

Range expansions typically occur when sub-adult males disperse from their mothers to establish their own home range (White et al. 2017). As these young males make excursions into areas of the GYE that have not been occupied by grizzly bears in more than a century, conflicts with livestock or humans occur. When lethal removal is the management option selected this could reduce the rate of range expansion. However, grizzly bears are typically given several opportunities to cause livestock or property related conflicts before being captured, relocated, or removed. Given, the negligibly low numbers of grizzly bears expected to be taken, we do not expect any significant indirect impacts to grizzly bears due to IPDM conducted by WS-Montana.

In some remote portions of Montana where livestock grazing occurs, it is often impractical to manage grizzly bears in conflict with livestock. Relocation is not an option in these remote, road-less areas; the only management tools are lethal removal or capturing and then freeing a bear on site. Each new generation learns feeding behaviors from their mothers. After adult females learn to prey on livestock, livestock predation becomes routine. In these remote situations lethal removal may stop the spread of this learned behavior. However, because removal is often impractical in these remote locations and the proposed take is expected to be minimal, it is unlikely WS-Montana IPDM activities would have such indirect impacts on feeding behaviors.

Social tolerance for grizzly bears may increase as tools for IPDM become more available. (Kleiven et al. 2004) found negative associations between acceptance of large carnivores and lack of personal control, economic loss, and respondents' age. IPDM provides people living with grizzly bears additional personal control and control over their economic losses. Reducing these negative associations with grizzly bears may increase social tolerance. Furthermore, an increased social tolerance could result in a reduction in illegal malicious kills of grizzly bears. While these indirect beneficial efforts may result from IPDM, it is unlikely that the amount of take proposed here by WS-Montana would have significant impacts on social tolerance of grizzly bears in Montana.

3.5.11.3.3 Cumulative Mortality

Multiple sources of grizzly bear mortality contribute to cumulative take inside the DMAs in Montana (Table 3.13). Mortalities are carefully tracked for each recovery zone including an estimation of the number of undocumented mortalities in some recovery zones. Known sources of human-caused mortality can include defense of life, illegal defense of property, illegal harvest by mistaking a grizzly bear for a black bear, agency removal, poaching/malicious kill, and train or vehicle collision (Costello et al. 2016).

MFWP reported an average of 8.6 agency removals of grizzly bears annually between 2013 and 2017, which is almost 11 times more lethal take than that by WS-Montana (Table 3.13). Known illegal take averaged 6.2 bears annually and varied between 4 and 10 grizzly bears annually between 2013 and 2017 (Table 3.13). Undoubtedly, additional illegal harvest occurred, but was not detected. Known cumulative take, including total WS-Montana take, averaged 15.6 grizzly bears a year with a maximum of 19 bears in 2013 (Table 3.13). The majority of these bears were taken from the NCDE and GYE. The USFWS authorizes all agency removals to ensure that the total number of mortalities in any given year remain below the mortality limit for each recovery zone. Beyond the DMA, grizzly bear mortalities or populations are not considered when determining whether recovery goals have been met; however, protection is still accorded to grizzly bears under the ESA (Wilson 2012). Under Alternative 1, we anticipate similar levels of cumulative take, with a maximum take of 21 grizzly bears annually by WS-Montana within the DMAs (Table 3.13). It is not the goal, nor the intent, of WS-Montana to meet this number (see Appendix E). The maximum estimated take accounts for the increasing number of conflicts (see Figure 3.9), increasing populations, and the potential for changes in cooperative management that may result in WS-Montana taking bears that previously would have been taken by MFWP. USFWS closely monitors population levels, lethal control for livestock protection, and other measurable sources of mortality (Kasworm et al. 2010, Mace and Roberts 2013, Kasworm et al. 2014, Mace and Roberts 2014, van Manen et al. 2014, Kasworm et al. 2015, van Manen et al. 2015, Costello and Roberts 2016, Kasworm et al. 2016, van Manen et al. 2016, Costello and Roberts 2017, Kasworm et al. 2017, van Manen et al. 2017, Costello and Roberts 2018, van Manen et al. 2018, Costello and Roberts 2019, Kasworm 2019, van Manen et al. 2019) to ensure mortality limits fall within the mortality limits set by the Recovery Plan and Revisions (U.S. Fish and Wildlife Service 1993, U.S. Forest Service 2006, Servheen 2016). The WS-Montana proposed annual maximum take would not contribute substantively to existing impacts regulated directly by USFWS.

To better understand how management removals impact each grizzly bear recovery zone, we analyze cumulative mortality by recovery zone in Tables 3.14a and b, 3.15, and 3.16 for the GYE, NCDE, and CYE, respectively.

Greater Yellowstone Grizzly Bear Mortalities

Various sources of grizzly bear mortality in the GYE contribute to "cumulative take" or total estimated mortality (Table 3.14a). WS-Montana removed an average of 0.4 grizzly bears annually from the GYE. In contrast the USFWS reports an annual average of 9 non-WS agency sanctioned removals between 2013 and 2017 (Table 3.14a). In addition, an average of 3.8 collared grizzly bears and an estimated 37 unmarked grizzly bears were killed or died of natural causes annually (Table 3.14a). Together this resulted in an average estimate of 50 mortalities annually ranging from 26 to 70 between 2013 and 2017. The highest mortality estimate is 70 grizzly bears in 2015, approximately 9.7% of the population that year. On average 6.9% of the grizzly bear population in the GYE dies annually (Table 3.14a). Under Alternative 1, we anticipate similar levels of cumulative take/total estimated mortality, with a maximum take of 10 grizzly bears annually by WS-Montana in the GYE (Table 3.14a). It is not the goal, nor the intent, of WS-Montana to meet this number (see Appendix E). The maximum estimated take accounts for the increasing number of conflicts (see Figure 3.9), increasing populations, and the potential for changes in cooperative management that may result in WS-Montana taking bears that previously would have been taken by MFWP. If WS-Montana were to take the annual maximum of 10 grizzly bears in the GYE, the projected cumulative take would be approximately 11.6% of the population, with WS-Montana contributing 1.4% to the cumulative amount. Projected total mortality is calculated based on the 5 year high for each mortality type and the maximum annual take of 10 grizzly bears in the GYE for WS-Montana.

Grizzly bear mortality thresholds in the GYE are based on age/sex classes (dependent young, independent females (>2 years), and independent males (>2 years)) and population size to achieve the population goal inside the DMA of 674 bears (U.S. Fish and Wildlife Service 2017a). Table 3.14b shows estimates of total mortality for each age/sex class relative to mortality thresholds. For the majority of the analysis period mortality thresholds for dependent young, independent females, and independent males were 7.6%, 7.6%, and 15%, respectively, while annual average mortality was 3.3%, 6.6%, and 10.5%, respectively (table 3.14b). There were individual years where the mortality threshold was exceeded. For example, in 2015 an estimated 10% of independent females died, and in 2016, an estimated 15.4% of independent males died. While mortality thresholds are evaluated annually, the recovery criteria for grizzly bears is met as long as the mortality limit for any sex/age class is not exceeded for three consecutive years (U.S. Fish and Wildlife Service 2017a).

Given the demonstrated ability of the USFWS to maintain total estimate mortality limits below stated thresholds (U.S. Fish and Wildlife Service 2017a), agency removal by WS-Montana and authorized by USFWS and MFWP will not cause cumulative mortality thresholds to be exceeded.

Table 3.14a. Population impact analysis of grizzly bear take inside the DMA of the GYE, CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional grizzly bear lethal take[1]	0	0	1	0	1	**0.4**	**1**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
MFWP/USFWS lethal take[2]	5	6	15	8	11	**9.0**	**15**
Known mortalities of collared bears[2]	5	3	2	2	7	**3.8**	**7**
Estimated mortalities of reported and unreported loss[2,3]	20	17	52	48	48	**37.0**	**52**
Total WS lethal take	0	0	1	0	1	**0.4**	**1**
Cumulative agency[2] removal	5	6	16	8	11	**9.2**	**16**
Total estimated mortality (Cumulative mortality)	30	26	70	58	67	**50.2**	**70**
Estimated Population[2]	741	757	723	695	718	**726.8**	**757**

WS Take % of Pop.	0.0%	0.0%	0.14%	0.0%	0.14%	**0.06%**	**0.14%**
Total Mortality Estimate as % of Population	4.0%	3.4%	9.7%	8.3%	9.3%	**6.9%**	**9.7%**
Projected WS Maximum Annual Take	10	Grizzly bears		1.4%	of population		
Projected Maximum Annual Cumulative Mortality	84	Grizzly bears		11.6%	of population		

[1] USDA-WS-APHIS Management Information System.
[2] Data from table 16 of Yellowstone grizzly bear annual reports (van Manen et al. 2016;2017;2018) and table 17 of earlier reports (van Manen et al. 2014, van Manen et al. 2015).
[3]This estimate includes the number of human-caused mortalities for dependent young.

Table 3.14b. Population impact analysis of grizzly bear take inside the DMA of the GYE, CY2013 - CY2017[1].

	Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
Total estimated human-caused mortality	Dependent young	0	2	13	9	12	**7.2**	**13**
	Independent females	18	7	25	12	21	**16.6**	**25**
	Independent males	12	17	32	37	33	**26.2**	**37**
Population estimate	Dependent young	225	230	224	215	217	**222.2**	**230**
	Independent females	258	263	249	240	250	**252**	**263**
	Independent males	258	263	249	240	250	**252**	**263**
% of population	Dependent young	0.0%	0.9%	5.8%	4.2%	5.5%	**3.3%**	**5.8%**
	Independent females	7.0%	2.7%	10.0%	5.0%	8.4%	**6.6%**	**10%**
	Independent males	4.7%	6.5%	12.8%	15.4%	13.2%	**10.5%**	**15.4%**
Mortality limit	Dependent young	7.6%	7.6%	7.6%	7.6%	9%	**-**	**9%**
	Independent females	7.6%	7.6%	7.6%	7.6%	9%	**-**	**9%**
	Independent males	15%	15%	15%	15%	20%	**-**	**20%**
Overall population estimate		741	757	723	695	718	**727**	**757**

[1] Adapted from table 18 of Yellowstone grizzly bear annual reports (van Manen et al. 2016;2017;2018) and table 17 of earlier reports (van Manen et al. 2014, van Manen et al. 2015). For dependent young, only human-caused mortality are counted against the mortality threshold. In contrast, all causes of mortality (natural, unknown, etc.) are counted against the mortality threshold for independent grizzly bears. This includes agency removals, loss of radio-collared individuals, reported losses, and an estimate of unreported loss (Table 3.14a). Table 3.12 depicts current mortality thresholds for grizzly bears in the GYE determined by the 2017 Supplement to the Recovery Plan for the GYE (U.S. Fish and Wildlife Service 2017a). Prior to this supplement the mortality threshold was 7.6% for dependent young, 7.6% for independent females, and 15% for independent males as set by the 2007 Supplement (USFWS 2007).

Northern Continental Divide Grizzly Bear Mortalities

Various sources of grizzly bear mortality in the NCDE contribute to "cumulative take" or total estimated mortality (Table 3.15). WS-Montana removed an average of 0.2 grizzly bears annually from the NCDE. In contrast the USFWS reports an annual average of 5.6

non-WS agency removals between 2013 and 2017. In addition, an average of 2.6 collared grizzly bears and an estimated 17 unmarked grizzly bears were killed or died of natural causes annually (Table 3.15). Together this resulted in an average estimate of 25.4 mortalities annually ranging from 16 to 39 between 2013 and 2017. The highest mortality estimate is 39 grizzly bears in 2015, approximately 3.8% of the population. On average 2.6% of the grizzly bear population inside the DMA of the NCDE dies annually (Table 3.15). Both the 5-year high and annual average are under the 4% mortality threshold for the NCDE. Under Alternative 1, we anticipate similar levels of cumulative take, with a maximum take of 10 grizzly bears annually by WS-Montana in the NCDE DMA (Table 3.15). It is not the goal, nor the intent, of WS-Montana to meet this number (see Appendix E). The maximum estimated take accounts for the increasing number of conflicts (see Figure 3.9), increasing populations, and the potential for changes in cooperative management that may result in WS-Montana taking bears that previously would have been taken by MFWP. If WS-Montana were to take the annual maximum of 10 grizzly bears inside the DMA of the NCDE, the projected cumulative take would be approximately 5.6% of the current population, with WS-Montana contributing 1% to the cumulative amount. The projected WS maximum annual take allows flexibility in which agency removes grizzly bears causing damage. In the event MFWP could not respond to conflicts and remove grizzly bears, WS-Montana would be able to increase grizzly take while still remaining below the 4% mortality threshold. Given that the population within the NCDE continues to grow each year (Table 3.15), it is likely the projected maximum annual mortality would fall quickly below the 4% threshold. Given the demonstrated ability of the USFWS to maintain total estimate mortality limits below stated thresholds (Table 3.15), agency removal by WS-Montana authorized by USFWS and MFWP will not cause cumulative mortality thresholds to be exceeded.

Table 3.15. Population impact analysis of grizzly bear take inside the DMA of the NCDE, CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional grizzly bear lethal take[1]	0	0	0	1	0	**0.2**	**1**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**
MFWP/USFWS lethal take[2]	11	3	4	4	6	**5.6**	**11**
Known mortalities of collared bears[2]	1	4	2	3	3	**2.6**	**4**
Estimated mortalities of non-collared bears[2]	10	9	22	14	30	**17.0**	**30**
Total WS lethal take	0	0	0	1	0	**0.2**	**1**
Cumulative lethal take/agency removal	11	3	4	5	6	**5.8**	**11**
Total estimated mortality	22	16	28	22	39	**25.4**	**39**
Estimated Population	939	960	982	1,005	1,028	**982.8**	**1,028**
WS Take % of Pop.	**0%**	**0%**	**0%**	**0.1%**	**0%**	**0.02%**	**0.1%**
Total Mortality Estimate as % of Pop.	2.3%	1.7%	2.9%	2.2%	3.8%	**2.6%**	**3.8%**

Projected WS Maximum Annual Take	10	Grizzly bears	1%	of population
Projected Maximum Annual Cumulative Mortality	55	Grizzly bears	5.6%	of population

[1] USDA-WS-APHIS Management Information System.
[2] Data from table 3 of NCDE annual reports (Costello and Roberts 2016;2017;2018), table 8 of Mace and Roberts (2014), and table 11 of (Mace and Roberts 2013).

Cabinet Yaak Ecosystem Grizzly Bear Mortalities

Various sources of grizzly bear mortality in the CYE contribute to "cumulative take" or total estimated mortality (Table 3.16). WS-Montana removed an average of 0.2 grizzly bears annually from the CYE. In addition, an average of 1 non-management related mortality was documented annually in the CYE between 2013 and 2017 (Table 3.16). Together this resulted in an average estimate of 1.2 mortalities annually ranging from 0 to 3 between 2013 and 2017. The highest cumulative mortality occurred in 2015 and was 5.5% of the high range of the population estimate at 55 bears and 6% of the low range of the population at 50 grizzly bears. On average, documented mortalities account for 1.2% - 2.3% of the grizzly bear population inside the recovery zone and 10-mile buffer of the CYE annually with WS-Montana take contributing 0.3% - 0.4% of the total amount (Table 3.16). This annual average cumulative mortality is under the 4% mortality threshold for the CYE.

Under Alternative 1, we anticipate similar levels of cumulative take, with a maximum take of 1 grizzly bear annually by WS-Montana in the CYE recovery zone and 10-mile buffer (Table 3.16). If WS-Montana were to take the annual maximum of 1 grizzly bear in the CYE, the projected cumulative mortality (based on the possibility of 3 non-management related mortalities) would be 7.3% - 8% of the conservative population range of 50-55, with WS-Montana contributing 1.8% to 2% to the cumulative amount. When projected cumulative mortality is calculated by adding 1 possible management removal to the annual average number of non-management related mortalities (1 grizzly bear), projected cumulative mortality would range from 3.6% to 4% based on the conservative population range of 50 to 55 grizzly bears in the CYE (Table 3.16), and cumulative mortality would remain at or below the 4% mortality limit imposed by the Recovery Plan (U.S. Fish and Wildlife Service 1993).

For the majority of the analysis period total mortality remained below the human-caused mortality threshold of 4%. However, in 2015 the threshold was exceeded when 3 non-management related, human-caused mortalities occurred. While mortality thresholds are evaluated annually, the recovery criteria for grizzly bears is met as long as the human-caused mortality threshold is not exceeded for three consecutive years (U.S. Fish and Wildlife Service 1993).

Table 3.16. Population impact analysis of grizzly bear take inside the CYE recovery zone and 10-mile buffer , CY2013 - CY2017.

Year	CY 2013	CY 2014	CY 2015	CY 2016	CY 2017	Average	5-Year High
WS intentional grizzly bear lethal take[1]	0	0	0	0	1	**0.2**	**1**
WS unintentional take[1]	0	0	0	0	0	**0**	**0**

MFWP/USFWS lethal take[2]	0	0	0	0	0	**0**	**0**
Known human-caused mortalities[2]	0	1	3	0	1	**1.0**	**3**
Total WS lethal take	0	0	0	0	1	**0.2**	**1**
Cumulative human-caused mortality	0	1	3	0	2	**1.2**	**3**
Estimated Population	50-55	50-55	50-55	50-55	55-60	**50-55**	**55-60**
WS Take % of Population	0%	0%	0%	0%	1.8 - 1.7%	**0.4 - 0.3%**	**1.8 - 1.7%**
Total Mortality Estimate as % of Population	0%	2 - 1.8%	6 - 5.5%	0%	3.6 – 3.3%	**2.3 – 2.1%**	**6 – 5.5%**
Projected WS Maximum Annual Take	1	Grizzly bear	2 – 1.8%	of population			
Projected Maximum Annual Cumulative Mortality	4	Grizzly bears	7.3% - 8%	of population			

[1] USDA-WS-APHIS Management Information System.
[2] Data from table 3 of Kasworm et al. (2018a) and W. Kasworm (personal communication, 10/9/2019).

3.5.11.4 Conclusion: Grizzly Bear

Given the growing population trend and expanding distribution for grizzly bears in the state and close monitoring and coordination by the USFWS and MFWP, cumulative human-caused mortality including take by WS-Montana, is not adversely impacting the population. Therefore, WS-Montana concludes that the cumulative impact of all recorded grizzly bear mortality in Montana, including intentional and unintentional take by WS-Montana, is not adversely impacting the size, sustainability, or recovery of the Montana grizzly bear population. In addition, the USFWS and MFWP monitor cumulative impacts to ensure that grizzly bears continue to meet recovery goals which include limits to human-caused morality in the CYE and NCDE and limits to total mortality in the GYE (U.S. Fish and Wildlife Service 1993;2017a). Therefore, WS-Montana's impact on the population has a built-in measure to assure that WS-Montana does not have an adverse cumulative impact on the population.

Should any population of grizzly bears in Montana be delisted, WS-Montana will issue a supplement to this EA analyzing the new management strategy.

3.5.12 What are the Direct and Cumulative Impacts on Feral and Free-Ranging Dog Populations?

3.5.12.1 Feral and Free-ranging Dogs Life History

Feral and free-ranging dogs are somewhat common in certain areas in Montana, where they often run in packs and prey on and harass livestock and poultry. Free-ranging dogs may be subsidized by food provided by owners, and depredation and harassment may be recreational. They can also cause safety concerns for people through threats and attacks. Free-ranging and feral dogs are also known to prey on and harass native wildlife such as deer and upland game. Primary responsibility for dog control rests with state, county, and municipal authorities.

Feral and free-ranging dogs are not part of the native environment and when left abandoned in the wild, feral and free-ranging dogs pose ecological problems because they can prey on native wildlife. Feral and free-ranging dogs may also carry and spread diseases, such as rabies and Rocky Mountain spotted fever (Centers for Disease Control and Prevention 2015).

3.5.12.2 Feral and Free-ranging Dog Population Information

In Montana, control of free-ranging dogs is generally the responsibility of local governmental agencies, county or municipal animal control officials, or county sheriffs. WS-Montana policy allows WS-Montana personnel to assist in feral and free-ranging dog control at the request of local authorities upon approval of the WS-Montana State Director. Efforts to address damage associated with feral and free-ranging dogs would be conducted in accordance with WS Directive 2.340 (Section 2.4.1) for controlling dogs.

Feral and free-ranging dogs are not managed by the State in Montana and no population estimates are available. There are an estimated 83.3 million dogs in the United States, but it is unknown how many have become feral or free-ranging (Bergman et al. 2009).

3.5.12.3 Feral and Free-ranging Dog Population Impact Analysis

3.5.12.3.1 WS-Montana Direct Effects on Feral and Free-ranging Dogs

WS-Montana recorded $18,794 in losses due to feral dogs during FY2013 – FY2017. These were losses to livestock, including an average of 16 animals killed or injured per year. In response to requests for assistance involving dogs, WS-Montana intentionally caught and transferred custody of 2 feral dogs to local animal control authorities in 2014. WS-Montana unintentionally removed 3 feral dogs during the period between FY2013 and FY2017. An additional 6 feral dogs were captured, and 4 were released and 2 were transferred to local animal control authorities between FY2011 and FY2015. All feral dogs are captured or removed on private and county or city lands using a variety of methods including hand captures, foothold traps, neck snares, and M-44s.

The lethal removal of feral and free-ranging dogs by WS-Montana has little impact on the human environment because feral and free-ranging dogs are not an indigenous component of ecosystems in Montana. WS-Montana addresses feral and free-ranging dogs at the request of the local authority for animal control and, thus, this action would likely occur in the absence of involvement by WS-Montana. WS-Montana expects the annual lethal removal of feral and free-ranging dogs in Montana to remain similar to previous years with an annual maximum take of 10 dogs (Appendix E).

3.5.12.3.2 Indirect Effects

Reducing the number of feral dogs, a non-native species, may potentially result in compensatory changes in reproduction. However, due to the negligibly low numbers of feral dogs WS is expected to take, we do not expect any significant indirect impacts due to IPDM conducted by WS-Montana.

3.5.12.3.3 Cumulative Mortality

Various sources of feral and free-ranging dog removals contribute to the cumulative take of feral and free-ranging dogs in Montana. Under Montana state law (MCA §81-7-401) dogs may be killed by the livestock owner, their agent/employee, or the dog owner if the dog is caught in the act of killing, injuring, or harassing livestock. MCA §81-7-402 states that any owner of a dog found in the act of killing or injuring livestock is liable for damages to the livestock. Other non-WS sources of take of feral and free-ranging dogs are not recorded, but are known to occur.

WS-Montana personnel are only authorized to control feral or free-ranging dogs when requested by the sheriff or other authority (WS Directive 2.340; Section 2.4.1). Consequently, most requests for assistance go to other agencies.

3.5.12.4 Conclusion: Feral and Free-ranging Dogs

Feral and free-ranging dogs are not an indigenous component of Montana ecosystems and are taken under very limited circumstances. Therefore, WS-Montana concludes that the cumulative impact of all recorded feral and free-ranging dog mortality in Montana, including intentional and unintentional take by WS-Montana, would have no deleterious impact on the human environment. As a non-native species in Montana, the removal of feral dogs is generally considered to have a positive impact on the environment. Therefore, no further analysis of population impacts is provided.

3.5.13 What are the Direct and Cumulative Impacts on Feral and Free-Ranging Cat Populations?

3.5.13.1 Feral and Free-ranging Cat Life History

Feral and free-ranging domestic cats are non-native and common throughout North America and Montana, and their wildlife prey have little defense against them. Cats are prolific breeders, having up to three litters of 4-8 kittens per year. Unlike many native predators, cats are not territorial and can exist at much higher densities than native predators. Feral and free-ranging cats can transmit deadly diseases (Section 1.11.6) such as rabies, feline leukemia and distemper to wild cats, wildlife, and in some cases humans. The incidence of rabies in cats is higher than in any other domestic animal in the United States (Birhane et al. 2017).

Studies (Mitchell and Beck 1992, Crooks and Soule 1999, Hawkins et al. 1999) of feral cats show that up to 70% of cats' prey is comprised of small mammals, up to 30% are birds, and the remainder of the diet is comprised of amphibians, reptiles, and insects. Birds that nest or feed on the ground are susceptible to cat predation, although cats are capable of catching birds by the wings and in trees. Loss et al. (2013) suggest that free-ranging domestic cats kill 1.3 to 4.0 billion birds and 6.3 to 22.3 billion mammals annually, and likely represent the greatest source of human-caused mortality (by virtue of cat ownership or support) for birds and mammals in the United States. They have been listed among the 100 worst non-native invasive species in the world (Lowe et al. 2000).

3.5.13.2 Feral and Free-ranging Cat Population Information

Today, cats may be the most widespread terrestrial carnivore on earth, with 74.1 to 85.8 million cats in the US, making cats the most popular pet in the country (American Veterinary Medical Association 2012). However, there may be 60 to 120 million stray, free-ranging, and feral cats in the U.S (American Veterinary Medical Association 2004, Lebbin et al. 2010). Feral and free-ranging cats are common in certain areas of Montana. Feral and free-ranging cats are not managed by the State of Montana, and as such, there are no population estimates for feral and free-ranging cats.

In Montana, control of feral cats is generally the responsibility of local governmental agencies, county or municipal animal control officials, or county sheriffs.

3.5.13.3 Feral and Free-ranging Cat Population Impact Analysis

3.5.13.3.1 WS-Montana Direct Effects on Feral and Free-ranging Cats

In response to damage and threat occurrences involving feral and free-ranging cats, WS-Montana intentionally removed a total of 2 feral and free-ranging cats between FY2013 and FY2017, one in 2014 and another in 2015. In addition, WS-Montana dispersed 3 feral cats in 2015. WS-Montana has not unintentionally removed any feral cats during the analysis period.

The lethal removal of feral and free-ranging cats by WS-Montana is considered to have little impact on the human environment because feral and free-ranging cats are not indigenous to the state. In addition, the annual numbers of feral and free-ranging cats removed by WS-Montana is extremely low compared to the thousands killed by animal control and humane organizations each year. The Humane Society estimates that 30 to 40 million cats are "community cats" (i.e., stray, abandoned, and/or feral, living outdoors; Humane Society of the United States 2017).

WS-Montana addresses feral and free-ranging cats at the request of the local authority for animal control and private individuals, thus, this action would likely occur in the absence of involvement by WS-Montana. WS-Montana expects the annual lethal removal of feral and free-ranging cats in Montana to remain similar to previous years. WS-Montana maximum take is not expected to exceed 5 feral cats annually (Appendix E).

3.5.13.3.2 Indirect Effects

Reducing the number of feral cats, a non-native species, may potentially result in compensatory changes in reproduction. However, due to the negligibly low numbers of feral cats WS is expected to take, we do not expect any significant indirect impacts due to IPDM conducted by WS-Montana.

3.5.13.3.3 Cumulative Effects

Various non-WS sources of feral and free-ranging cat removals contribute to the cumulative take of feral and free-ranging cats in Montana. However, the sources of these removal numbers vary from municipal animal control, shelters, and other public and private entities, and the number of removals are unknown.

3.5.13.4 Conclusion: Feral and Free-ranging Cats

Feral and free-ranging cats are not an indigenous component of Montana ecosystems and are taken under very limited circumstances. Therefore, WS-Montana concludes that the cumulative impact of all recorded feral and free-ranging cat mortality in Montana, including intentional and unintentional take by WS-Montana, would not adversely impact the size or sustainability of the Montana feral and free-ranging cat population.

3.5.14 What are the Direct and Cumulative Impacts on Bobcat Populations?

3.5.14.1 Bobcat Life History Information

Bobcats are found in much of the United States and southern Canada to most of Mexico, and are very abundant in the western U.S. Bobcats have become more abundant in North America and in Montana than they were in 1981 (Roberts and Crimmins 2010, Giddings 2014) and are relatively common statewide in Montana. They are typically associated with brushy, rocky and wooded areas, and rimrock and chaparral habitat, especially where ledges occur. Prey abundance, protection from severe weather, availability of rest areas, dense cover, and freedom from disturbance are key factors (McCord 1974, Donovan et al. 2011). Bobcats are opportunistic and frequently prey on rabbits, rodents, squirrels, and other medium-sized rodents. Bobcats are resilient, and populations are doing well in the United States except in areas of dense human populations and extensive agriculture.

Bobcats reach reproductive maturity at 9 to 12 months and have one to six kittens in early- to mid-summer (Crowe 1975, Brainerd 1985, Koehler 1987). Older male and female bobcats usually have a territory that is fairly well defined, but which varies in size depending on prey density, sex, season, presence of kittens, and climate. Transient animals coexist with territorial resident animals by using less-desirable habitats. Dispersal of young bobcats generally occurs in fall or late winter. They may live up to 14 years, but annual mortality is as high as 47% (Rolley 1985).

3.5.14.2 Bobcat Population Information

Bobcats are classified as a furbearer by MFWP (MCA §87-2-101) and as such MFWP is responsible for their management. Under MCA §87-6-106 (Section 2.4.4.1), landowners or their agents can remove bobcats on private land when bobcat are attacking, killing, or threatening to kill livestock without a permit from MFWP. All take under MCA §87-6-106 must be reported to MFWP within 72 hours. WS-Montana works with MFWP to provide IPDM to reduce bobcat damage, especially to livestock. WS-Montana provides MFWP with information on take for population management purposes.

Montana residents may purchase a trapper license, which is required to hunt or trap bobcats on public or private lands, during the regulated harvest season from December 1 through February 15 (western portion of state, trapping districts 1-3) or March 1 (eastern portion of state, trapping districts 4-7). A person may take no more than 7 bobcats from trapping districts 1-3 combined, although each trapping district has its own limits (district 1 – 1 bobcat, district 2 – 7 bobcats, and district 3 – 5 bobcats). The eastern region (trapping districts 4-7) has no limit. MFWP requires trappers and hunters to report all harvested bobcats (within 24 hours) and to present the pelt and lower jaw of each bobcat harvested (within 10 days) to monitor quota levels, assess age structure, and monitor population trends (Montana Fish Wildlife and Parks 2019a). From this reporting, MFWP is able to monitor total harvest, hunter-harvest effort, percentage of females, and percentage of young in the harvest.

These analyses allow MFWP to set quotas in each trapping district to ensure a stable bobcat population.

Reported bobcat densities, as summarized by McCord and Cardoza (1982), have ranged from 0.1 to 7 per mi^2. Knick (1990) estimated that bobcat densities in southeastern Idaho ranged from $0.04/mi^2$ to $0.35/mi^2$, depending on jackrabbit densities. Bailey (1974) estimated bobcat densities in the same area to average about $0.14/mi^2$. Knowles (1981) estimated a bobcat density of $0.05/mi^2$ on the Charles M. Russell National Wildlife Refuge in north-central Montana. This estimate represents two years in which rodent densities peaked (1979) and rapidly declined (1980) (Knowles 1981). Newell and Podruzny (2018) report bobcat densities in Montana ranging from a low of $0.013/mi^2$ in trapping district 6 to a high of $0.2/mi^2$ in trapping district 7 based on harvest data collected from 2000-2016. We use the very conservative density estimate of 0.05 bobcats/mi^2 from Knowles (1981) to estimate 7,350 bobcats statewide. Although this estimate is based on bobcat densities estimated in 1979 and 1980, this population estimate is consistent and slightly more conservative than the population estimate of 7,641 reported in (Roberts and Crimmins 2010) for Montana. (Newell and Podruzny 2018) recently estimated the statewide population of bobcats in Montana using a scaled population estimate from harvest data that accounts for variation in harvest effort which can be affected by pelt prices, weather, and quotas. Population estimates generated from bobcats harvested between 2000-2016 show periods of population growth (2003-2008) and periods of population decline (2000-2003 and 2008 to 2014, (Newell and Podruzny 2018). Population estimates from 2014-2016 fluctuate as expected due to the nature of incorporating backdated harvest data into model estimate (Newell and Podruzny 2018), therefore, the scaled population estimate averaged between 2000-2016 (7,156 bobcats), a very conservative estimate, will be used as a population estimate for all impact analyses below.

A bobcat population model developed by Knick (1990) based on seven years of intensive bobcat research in southeastern Idaho indicated that bobcat populations can sustain harvest levels of up to 20% of the population. Rolley (1985) also estimated that bobcats can sustain a 20% annual harvest.

3.5.14.3 Bobcat Population Impact Analysis

3.5.14.3.1 WS-Montana Direct Effects on Bobcats

Requests for WS-Montana to assist with bobcats causing damage are relatively low. Most requests for assistance involve conflicts with smaller livestock including chickens, lambs, and goats and threats to aircraft and airport personnel safety. WS-Montana intentionally removed an average of 0.2 bobcats per year between FY2013 and FY2017, and WS-Montana unintentionally removed an average of 0.2 bobcats per year during the analysis period (Table 3.17). This corresponds to an annual average of 0.01% of the population (Table 3.17). Bobcats are primarily taken with neck snares on private lands (Tables 2.1 and 2.2; Appendix E).

Based on the number of cooperative service agreements, county, state and federal budgetary constraints, and projected future requests for assistance, WS-Montana expects that future bobcat removals for IPDM would be similar to take during the last five years and would not exceed 15 bobcats (Appendix E). This corresponds to an annual average of 0.2% of the statewide population (Table 3.17). This level of take would be expected to have a negligible impact on bobcats locally, and no impact on the statewide bobcat population.

3.5.14.3.2 Indirect Impacts

We considered potential indirect impacts due to increased immigration rates and distances, and increased fecundity, potentially resulting in changes in local population age structure. However, due to the negligibly low numbers of bobcats WS-Montana might take under Alternative 1 (less than 0.2% of their estimated population), any indirect impacts of such take would be negligible.

3.5.14.3.3 Cumulative Mortality

Bobcat take by various entities contributes to cumulative take in Montana (Table 3.17). Unknown and unreported mortality cannot be calculated for bobcats; however WS-Montana has used maximum take projections and conservative population estimates to consider potential impacts. MFWP reports that furbearer harvest removed an average of 1,375 bobcats per year from FY2013 - FY2017, while an average of 0.4 bobcats were taken by WS-Montana (Table 3.17). The average annual cumulative take of bobcat is 1,375.5 per year. The highest statewide known cumulative take was 1,641 bobcats per year, approximately 22.9% of the total estimated population, with WS-Montana contributing 0.01% of the cumulative amount, relative to the annual maximum sustainable harvest of 20% (Table 3.17). If WS-Montana were to take the annual maximum take of 15 bobcats, the projected cumulative take would be approximately 23.1% of the population, with WS-Montana contributing 0.2% to the cumulative amount.

MFWP responded to a decline in bobcat populations during the 2014-15 harvest season by decreasing quotas in trapping districts 4, 5, and 6 by a combined 190 animals for the 2015-2016 trapping season (Associated Press 2015). MFWP's recent analysis of bobcat harvest and population trends (Newell and Podruzny 2018) revealed significant differences in how bobcat populations recovered in eastern (trapping districts 4-7) and western Montana (trapping districts 1-3) after the 2014-2015 population decline. (Newell and Podruzny 2018) state that after statewide declines in bobcat populations during the 2014-15 trapping season, populations in the western half of the state recovered to a level as high at least as high as the long-term average in that trapping district whereas populations in the eastern half of the state remain well below the long-term average despite increasing population estimates. This study makes recommendations for reductions to quotas in trapping districts 4 and 5 by 75-100 animals each to maintain a well distributed and robust population of bobcats while continuing to provide recreational opportunities for bobcat harvest.

Bobcat populations are considered to be stable throughout their range, and they are listed as a species of "least concern" according to the (International Union for Conservation of Nature 2017).

3.5.14.3.4 Conclusion: Bobcat

Bobcats are intensively managed by MFWP at statewide and regional scales. If bobcat mortality exceeds their thresholds in any area or on any scale, MFWP has the authority and intent to change bobcat management rules, such as seasons, methods, quotas, and bag limits. For example, in 2018, MFWP proposed reducing quota in trapping district 3 by 100 bobcats in response to a decline in bobcat and rabbit abundance (Associated Press 2018). Given WS-Montana's extremely limited bobcat take, MFWP's management objectives are not influenced by WS-Montana. As such, WS-Montana has little or no ability to impact bobcat populations in the State, particularly given the extremely low average annual take by WS-Montana. Should an increase in requests for assistance with bobcats result in the projected annual WS maximum take, cumulative impacts on the statewide bobcat population would still be expected to remain at 23.1% (Table 3.17) near the annual maximum sustainable harvest level of 20% (Section 3.5.14.2). WS-Montana concludes that the WS-Montana proposed maximum take would not contribute substantively to existing impacts regulated directly by MFWP.

Table 3.17. Population impact analysis of bobcat take in Montana, FY2013 - FY2017.

Year	FY 2013	FY 2014	FY 2015	FY 2016	FY 2017	Average	5-Year High
WS intentional bobcat take[1]	0	1	0	0	0	**0.2**	**1**
WS unintentional take[1]	1	0	0	0	0	**0.2**	**1**
Furbearer Harvest[2]	1,638	1,639	1,297	1,107	1,194	**1,375**	**1,639**
Total WS take	1	1	0	0	0	**0.4**	**1**
Cumulative Take	1,639	1,640	1,297	1,107	1,194	**1,375.5**	**1,640**
Estimated Population	7,156	7,156	7,156	7,156	7,156	**7,156**	**7,156**
WS Take % of Pop.	0.01%	0.01%	0.00%	0.00%	0.00%	**0.01%**	**0.01%**
Cumulative Take % of Pop.	22.9%	22.9%	18.1%	15.5%	16.7%	**19.2%**	**22.9%**
Projected WS Maximum Annual Take	15	bobcats		0.2%	of population		
Projected Maximum Annual Cumulative Take	1,654	bobcats		23.1%	of population		

[1] USDA-WS-APHIS Management Information System.
[2] Furbearer harvest is reported through voluntary surveys from licensed furbearer trappers (available data is from 2012-2016 https://myfwp.mt.gov/fwpPub/harvestReports and from personal communications for the 2017 furbearer report (B. Inman, 4/12/2019).

3.5.15 What are the Direct and Cumulative Impacts on Feral Swine Populations?

3.5.15.1 Feral Swine Life History Information

Feral swine are not native to the Americas. They were first brought to the United States in the 1500s by early explorers and settlers as a source of food. Free-range livestock management practices and escapes from enclosures led to the first establishment of feral swine populations within the United States. In the 1900s, the Eurasian or Russian wild boar was introduced into parts of the United States for the purpose of sport hunting. Today, feral swine are a combination of escaped domestic pigs, Eurasian wild boars, and hybrids of the two.

Feral swine have been reported in at least 35 states. Their population is estimated at over 6 million and is rapidly expanding. Range expansion over the last few decades is due to a variety of factors including their adaptability to a variety of climates and conditions, translocation by humans, and a lack of natural predators. Feral swine, a non-indigenous species, cause damage to a variety of resources and negatively impact and compete with native flora and fauna. Feral swine have the highest reproductive rate of any ungulate species (Read and Harvey 1989) and are considered by many wildlife professionals to be an undesirable component of North American wild and native ecosystems.

3.5.15.2 Feral Swine Population Information

Any reduction in feral swine populations in North America, even to the extent of complete eradication, is desirable and would have a beneficial impact to native wildlife and the agricultural community. Controlling feral swine populations represents a significant challenge given their high reproductive rate. Furthermore, research in New Zealand suggests that feral swine can withstand a 70 percent population reduction and rapidly return to pre-control levels (Dzięciołowski et al. 1993).

In Montana, feral swine are defined as a hog, boar, or pig that appears to be untamed, undomesticated, or in a wild state or appears to be contained for commercial hunting or trapping (MCA §81-29-101), and the goal is to prevent feral swine from becoming established in the state. Individuals may not import, transport, possess, intentionally feed, expand the range, or profit from the release, hunting, trapping, or killing of feral swine (MCA §81-29-104). Furthermore, individuals may not intentionally, knowingly, or negligently allow swine to live in a feral state (MCA §81-29-104). Feral swine must be reported to the Board of Livestock (MCA §81-29-103) part of MDOL. Additionally, an individual, a state agency, or a federal agency authorized by the state or the federal government is allowed to control or eradicate feral swine (MCA §81-29-102), and an individual who encounters feral swine on their owned or leased property may immediately eradicate the feral swine if it poses an immediate threat of harm to a person or property, or will expand its range without immediate eradication (MCA §81-29-103).

WS-Montana has not verified the occurrence of feral swine in the state; however, there are occasional reports. The uncontrolled, growing population of feral swine in Saskatchewan, Canada is likely to colonize northern Montana. The state's goal is to remove the animals before the population becomes established, damage increases, and the swine become more difficult and expensive to eradicate.

3.5.15.3 Feral Swine Population Impact Analysis

3.5.15.3.1 WS-Montana Direct Effects on Feral Swine

Because feral swine are not native to Montana and negatively impact native flora and fauna, any level of removal (including eradication) is desirable. Executive Order 13112 directs federal agencies to use their programs and authorities to prevent the introduction of invasive species, control populations of invasive species, and minimize the economic or environmental harm, or harm to human health caused by invasive species. Removal of feral swine from Montana is also part of a national effort to reduce the range and size of the feral swine population in the United States (USDA Animal and Plant Health Inspection Service et al. 2015).

While no feral swine have been documented in Montana, WS-Montana has flown several times to investigate potential sightings of feral swine. WS-Montana proposes to remove up to 50 feral swine annually in accordance with provisions of written agreements with affected landowners/managers and the MDOL. WS-Montana will be working to document the occurrence and range of feral swine on private, BLM, and state land. We anticipate feral swine sighting will most likely to occur in Phillips, Blaine, Valley, Daniels, Sheridan, & Roosevelt counties in north central Montana; however, feral swine removal could occur anywhere they are detected in the state.

3.5.15.3.2 Indirect Effects

Reducing the number of feral swine, a non-native species, may potentially result in compensatory changes in reproduction. However, because the stated goal is eradication, any compensatory changes in reproduction would likely be overwhelmed by efforts to removed feral swine. Therefore, we do not expect any significant indirect impacts due to IPDM conducted by WS-Montana.

3.5.15.3.3 Cumulative Mortality

Should feral swine colonize Montana, various non-WS sources of feral swine removals could contribute to the cumulative take of feral swine as allowed under MCA §81-29-102 and §81-29-103. The goal of feral swine management in Montana is to prevent colonization and eradicate any feral swine that move into the State.

3.5.15.4 Conclusion: Feral Swine

Feral swine are not an indigenous component of Montana ecosystems. Therefore, WS-Montana concludes that the cumulative impact of all potential feral swine mortality in Montana, including future intentional and unintentional take by WS-Montana, would not adversely impact the environment. Rather, the proposed actions would prevent habitat destruction by an invasive species.

3.5.16 What are the Comparative Impacts of the Alternatives on Predator Populations?

3.5.16.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

The take for all target predator species killed by WS-Montana on all land classes is presented for each species as a yearly total and five-year average for FY2013- FY 2017 (Tables 3.2, 3.3, 3.5-3.11, and 3.12-3.17, Table 2.2, and Appendix E) and summarized in Table 3.18. Between FY2013 and FY2017, the target species with the greatest average yearly take by WS-Montana for IPDM were coyotes (*n*=6,386.6), red fox (*n*=179.6), and ravens (*n*=121.2). All other predator species intentionally taken by WS-Montana are at an average of less than 60 per year. Table 2.2 provides intentional lethal take proportions for predators as: coyotes (94.1%), red fox (2.65%), and ravens (1.79%). All other species take represents less than 1% of WS-Montana total predator take per species.

Virtually all resource owners have used or attempted one or more non-lethal methods on their own prior to non-lethal and/or lethal assistance from WS-Montana (Section 1.11.2.6). Environmental factors that may impact the extent to which animals are attracted to human-related food sources; fluctuations in livestock markets and herd population dynamics; predator population dynamics; range expansion by predators, humans, pets, and livestock; and IPDM funding fluctuations affect WS-Montana's capability to respond to requests for assistance. Regardless, WS-Montana expects that intentional take of predators in the foreseeable future will be similar to levels recorded from FY2013 through FY2017.

For all predator species in Montana included within the scope of this EA, except for gray wolves, grizzly bears, black bears, and bobcats, the annual statewide known cumulative take is substantially below the annual maximum sustainable harvest level (Tables 3.2 through 3.18) as determined by a review of the available scientific literature. This indicates that cumulative take of these species is below the level of take that could adversely affect the statewide populations. While take for black bears is below the level of sustainable harvest, known cumulative take does approach annual maximum sustainable harvest (Table 3.18). Because population estimates are conservative, all estimates of cumulative take as a percentage of the population are liberal. Thus, it is highly unlikely that cumulative take would exceed the level of maximum sustainable harvest. Cumulative take for wolves does exceed some estimates of maximum annual sustainable harvest, but not the most liberal estimates of maximum sustainable harvest. Cumulative take for bobcats exceeds the conservative estimate maximum annual harvest level by 3% despite WS-Montana averaging take of less than one bobcat annually. MFWP's 2018 analysis of bobcat harvest recognized the potential impact of harvest on the bobcat population and made recommendations to reduce harvest in portions of the state (Newell and Podruzny 2018). In all cases for these species (wolves, black bears, and bobcats), WS-Montana's lethal take as a part of IPDM is a small portion of populations when compared to hunter harvest, and for wolves, IPDM is an important tool in managing social tolerance (Kleiven et al. 2004).

The proportion of take by WS-Montana compared to the cumulative take shows that WS-Montana has substantially lower total and proportional take of all species compared to non-WS sources. WS-Montana only takes 0.11% of the cumulative take of black bears compared to 12.99% for other sources of mortality, 7.6% of the cumulative take of gray wolves compared to 28.7% for other sources of mortality, and 0.01% of the cumulative take of bobcats compared to 22.89% for other sources of mortality. Even considering the projected WS annual maximum take, which is a liberal estimate, WS-Montana take for every species, except bobcats, is below estimates of annual maximum sustainable harvest to ensure healthy and stable or increasing predator populations.

Populations of feral/free-ranging cat and feral and free-ranging dog populations are unknown, and many free-ranging cats and dogs live with and are subsidized by their owners. There are currently no known populations of feral swine in Montana; however an abundance are just across the border in Saskatchewan, Canada. All three of these species;

feral cats, dogs, and swine, are non-native species which can cause significant threats to native species, livestock, and/or agriculture.

Cumulative take and WS-Montana's direct incremental contribution to that cumulative take are below the maximum sustainable harvest levels for all species, except bobcat. When reviewing the trend data available for these predator species, and establishing annual harvest quotas and or seasons, MFWP has determined that the level of known and unknown harvest levels are not negatively impacting the populations of predators in the state. WS-Montana is not and would not adversely impact any native predator populations.

Table 3.18. Summary of WS-Montana intentional take and known cumulative take, FY 2013 - FY 2017[1].

Species	Current total WS take as a % of the population[2]	Current cumulative take as a % of the population[3]	Projected maximum annual cumulative take as a % of the population[4]	Annual maximum sustainable harvest
Coyote	12.2%	46.8%	52.7%	60%
Red fox	0.6%	7.0%	7.6%	64%
Raven	0.4%	0.5%	1.6%	12%
Gray wolf	7.6%	36.3%	43.1%	20-50%
Mountain lion	0.5%	15.6%	16.7%	30-32%
Black bear	0.11%	13.1%	13.4%	16%
Badger	0.01%	1%	1%	10%
Raccoon	0.007%	4.5%	4.5%	49%
GYE Grizzly bear	0.1%	9.7%	11.6%	variable[5]
NCDE Grizzly bear	0.1%	3.8%	5.6%	4%[5]
CYE Grizzly bear	1.8-1.7%	6-5.5%	7.3-8%	4%[5]
Feral/free-ranging cat	--	--	--	n/a
Feral/free-ranging dog	--	--	--	n/a
Bobcat	0.01%	22.9%	23.1%	20%
Feral swine	--	--	--	n/a

[1] These data are from Tables 3.2, 3.3, 3.5-3.11, and 3.12-3.17.

[2] The proportion of the estimated species population taken by WS-Montana in the year with the highest WS-Montana take between FY2013 - FY2017.

[3] The proportion of the estimated species population taken by all sources in the year with the highest take between FY2013- FY2017.

[4] Provides an estimate of the highest proportion of the estimates species population that could be taken by all sources based on a conservative population estimate, under projected WS annual maximum take scenario.

[5] Mortality limits for grizzly bears set by the Recovery Plan (U.S. Fish and Wildlife Service 1993;2017a) are presented rather than estimates of maximum sustainable harvest. For grizzly bears in the GYE, mortality limits are set on a sliding scale relative to population estimates (Table 3.12).

3.5.16.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and resource owners would likely continue to conduct IPDM activities as described in Section 3.4, with reported take incorporated into the cumulative impact analysis, as in Alternative 1. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have adequate experience or response capability with some of the conflict species and methods, especially if they are not already conducting IPDM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Depending on the readiness and interest of other entities to conduct IPDM activities, the cumulative number of predator removals could be greater than, less than, or similar to the cumulative take under Alternative 1. It is possible that more predators could be taken by other entities, as a result of less selective removals. Conversely, fewer predators may be removed in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, individuals experiencing damage may not take action themselves, and/or individuals may be less efficient in taking action themselves. Lastly, there is the potential for predators to be removed by other entities at a similar level to WS-Montana's lethal take under Alternative 1.

Under Alternative 2, other entities would be expected to have a level of take similar to the cumulative take under Alternative 1. Predator populations are expected to be stable. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. Further, cumulative take would not near annual maximum sustainable harvest levels established for the predator species, despite any reasonably foreseeable levels of increased take by other entities.

3.5.16.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. Lethal methods applied by WS-Montana would have similar impacts on predator populations as those analyzed under Alternative 1. Non-lethal methods would not likely contribute substantially to direct or cumulative impacts on predator species. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would be likely to continue to conduct IPDM activities as described in Section 3.4.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. However, entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1.

Cumulative levels of take would be expected to be similar to Alternative 1 and would not be expected to near the maximum sustainable harvest levels for predator species. Therefore, predator populations are expected to be stable with similar levels of impacts as under Alternative 1.

3.5.16.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. All predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. Because of the limited circumstances regarding lethal control under this alternative, the impacts on predator populations from WS-Montana would be less than those described for Alternatives 1 and 3, because fewer predators would be removed. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, because WS-Montana would not be able to respond with lethal methods to damage or threats to any other resources or situations, entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1.

Cumulative levels of take would be expected to be similar to Alternative 1 and would not be expected to near the maximum sustainable harvest levels for predator species. Therefore, predator populations are expected to be stable with similar levels of impacts as under Alternative 1.

3.5.16.5 Alternative 5. No WS-Montana Involvement in IPDM Activities

Under this alternative, WS-Montana would have no effect on predator populations. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Without WS-Montana's technical and operational assistance, other entities may be less efficient and effective, potentially resulting in more predators being taken. Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1.

In the absence of WS-Montana's assistance, the effects on predator species populations would likely be higher than under Alternatives 1-4.

3.6 What are the Effects of WS-Montana IPDM on Threatened and Endangered Species?

WS-Montana is responsible for ensuring its actions are in compliance with the federal Endangered Species Act (ESA) which is the focus of this section.

The State of Montana also maintains a list of endangered species (MCA §87-5-107), but its prohibitions and reach is less broad than the federal ESA and is only applied to species already listed on the federal level. All of the state-listed threatened and endangered species are also included on the federal list and therefore have been considered in this EA. Federal ESA always supersedes the State if the protections are more stringent.

3.6.1 How Has WS-Montana Considered Potential Impacts on Threatened and Endangered Species?

As a federal agency, WS-Montana reviews its proposed activities for the potential to affect federally-listed threatened and endangered (T&E) species and designated critical habitat. When WS-Montana determines a listed species may potentially be affected by its activities in any way, it consults with the USFWS pursuant to Section 7 of the ESA. WS-Montana has completed informal and formal consultation with the USFWS for effects from all of its activities on federally-listed T&E species. Effects of WS-Montana activities on federally listed species in Montana were evaluated by the USFWS in Biological Opinions for impacts on listed Canada lynx (July 24, 2009) and grizzly bears (June 8, 2012). WS-Montana determined that PDM activities will have No Effect on all other listed species (whooping crane, Eskimo curlew, piping plover, interior least tern, yellow-billed cuckoo, red knot, black-footed ferret, northern long-eared bat, pallid sturgeon, white sturgeon, bull trout, water howellia, Spalding's catchfly, Ute ladies' tresses, western glacier stonefly, and meltwater lednian stonefly; dated April 27, 2015 and February 21, 2020). The pertinent descriptions of WS-Montana IPDM activities that are incorporated into the Biological Opinion are included in Section 2.3.1 for Alternative 1 and detailed in Appendix A.

3.6.2 Which T&E Species Would Not be Affected by WS-Montana IPDM Activities?

WS-Montana has determined that its IPDM activities would have no effect on certain T&E species because WS-Montana does not conduct IPDM in areas where these species occur or in a manner that would affect these species or their critical habitat. Species that would not be affected by WS-Montana IPDM activities are listed below.

- **Species of fish:** Pallid Sturgeon (*Scaphirhynchus albus*), White Sturgeon (Kootenai River population; *Acipenser transmontanus*), Bull trout (Columbia River basin and St. Mary – Belly River populations; *Salvelinus confluentus*)
- **Species of mammals**: Black-footed Ferret (*Mustela nigripes*), Northern Long-eared Bat (*Myotis septentrionalis*)
- **Species of birds:** Whooping Crane (*Grus americana*), Least Tern (*Sterna antillarum*), Piping Plover (*Charadrius melodus*), Yellow-billed cuckoo (western population; *Coccyzus americanus*), Red Knot (*Calidris canutus rufa*)
- **Species of invertebrates:** Meltwater Lednian Stonefly (*Lednia tumana*), Western Glacier Stonefly (*Zapada glacier*)
- **Species of plants:** Water howellia (*Howellia aquatillis*), Ute Ladies'-tresses (*Spiranthes diluvialis*), Spalding's Campion (or "catchfly") (*Silene spaldingii*)

- **Critical habitat:** Bull trout (Columbia River basin and St. Mary – Belly River populations; *Salvelinus confluentus*), Piping Plover (*Charadrius melodus*)

Protective measures to avoid T&E impacts were described in Chapter 2. Those measures should ensure that the proposed action (Alternative 1) will not have adverse effects on T&E species. Of the federally listed species occurring in Montana, PDM has the potential to adversely affect certain terrestrial vertebrate species (mammals), as discussed in Section 3.6.4. Two T&E species could be adversely affected by PDM activities.

WS-Montana PDM will have no effect on any of Montana's T&E fish species or critical habitat because PDM methods will not affect water or wetlands, and PDM activities are not generally conducted in aquatic or wetland environments.

Montana does not have any listed reptile or amphibian species.

WS-Montana PDM will have no effect on any of Montana's T&E plant species because PDM activities do not modify or impact habitat to any extent, and PDM activities are not generally conducted in the habitats of such species. Moreover, WS-Montana follows protective measures (as discussed in Chapter 2) to minimize or eliminate any potential impact to these species. Such protective measures cover the plant species listed above. Additionally, while conference is not required for proposed and candidate species under ESA, WS-Montana has determined that its PDM activities would have no effect on whitebark pine (*Pinus albicaulis*). WS-Montana does not conduct IPDM in a manner that would affect these species or their critical habitat.

WS-Montana PDM will also have no effect on the western glacier stonefly or the meltwater lednian stonefly. The remoteness of their high-elevation alpine habitats largely precludes overlap with human uses.

WS-Montana PDM will also have no effect on the following federally listed avian species: least tern, piping plover, whooping crane, red knot, and yellow-billed cuckoo. WS-Montana PDM activities are not generally conducted in the habitats of, or in a manner that would affect, such species. Moreover, WS-Montana follows protective measures (as discussed in Chapter 2) to minimize or eliminate any potential impact to these species.

WS-Montana PDM will have no impact on black-footed ferrets or northern long-eared bats. WS-Montana PDM activities are not generally conducted in a manner that would affect such species.

Moreover, WS-Montana follows protective measures (as discussed in Chapter 2) to minimize or eliminate any potential impact to these species. USFWS and MFWP monitor several species considered threatened or endangered in Montana to determine if different activities singly or in combination are impacting their populations (i.e., a cumulative impact analysis). Mortality for T&E species is monitored where feasible. But mortalities due to road kills, loss of habitat (e.g., land development, construction, housing, industrial complexes, road construction, mining, and oil and gas development), and natural disasters (e.g., fires, floods, lightning, heavy winters, and drought) are the same under all alternatives and much of this activity that results in mortality or population limiting factors is difficult to determine. These factors are not likely to be determined definitively even with unlimited funding: they can only be estimated based on population trend monitoring (increasing, decreasing, or stable). The availability of habitat is often the most critical concern because the available habitat determines the population which an area can support. WS-Montana has never taken any of the species listed above and does not foresee any potential for the take of such species by WS-Montana under any alternative. WS-Montana consults with MFWP and USFWS, as necessary, to provide them with information regarding WS-Montana's potential to take these species using existing PDM methods. WS-Montana has determined that one or more PDM activities has/have the potential to adversely affect two T&E species.

3.6.3 Which T&E Species May Be Affected by IPDM Activities?

WS-Montana has determined that grizzly bears and Canada lynx were likely to be adversely affected (LAA) by some aspects of IPDM. The effects analysis for each of these species are summarized below.

3.6.4 What are the Potential Effects on Specific Threatened and Endangered Animal Species?

3.6.4.1 Grizzly Bear

The grizzly bear (*Ursus arctos horribilis*) is one of two subspecies of the brown bear (*Ursus arctos*) which occupy North America. Historically, the grizzly bear ranged from the Great Plains to the Pacific Ocean and from Alaska to Mexico. Today, the grizzly bear is found in only about 6% of its original range in the lower 48 states presently occupying only parts Montana, Idaho, Wyoming, and Washington (Haroldson et al. In press). It was listed as threatened south of Canada in July of 1975.

The comparative and cumulative impacts on grizzly bears are covered in extensive detail in Section 3.5.11. All grizzly bear take by WS-Montana is done at the request and under the authorization of USFWS and MFWP. Take is performed in accordance with 50 CFR § 17.40 special rules. Given the growing population trend and expanding distribution for grizzly bears in the state (Section 3.5.11.3) and close monitoring and coordination by the USFWS and MFWP, cumulative human-caused mortality, including take by WS-Montana, is not adversely impacting the population. Therefore, WS-Montana concludes that the cumulative impact of all recorded grizzly bear mortality in Montana, including intentional and unintentional take by WS-Montana, is not adversely impacting the size, sustainability, or recovery of the Montana grizzly bear population. In addition, the USFWS and MFWP monitor cumulative impacts to ensure that grizzly bears continue to meet recovery goals which include limits to human-caused mortality in the CYE and NCDE and limits to total mortality in the GYE (U.S. Fish and Wildlife Service 1993;2017a). These monitoring efforts act as a built-in measure to assure that WS-Montana does not have an adverse cumulative impact on grizzly bear populations.

Given the conservation measures implemented by WS-Montana and APHIS-WS' history of very minimal unintended captures, it is extremely unlikely that the proposed IPDM activities would result in a capture. Based on the above information and information presented in the WS Biological Assessment, the USFWS Biological Opinion concluded that the proposed action would not jeopardize the grizzly bear population in Montana (Wilson 2012). The Biological Opinion stipulates that, in the event that WS-Montana incidentally captures five grizzly bears over the twenty year life of the document, WS-Montana and USFWS will review the circumstances of the events, and determine whether modifications of methods or additional conservation measures are needed to avoid additional take of grizzly bears (Wilson 2012). The reinitiation triggers for consultation established in 50 CFR 402.16 are as follows:

"Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: 1) the amount or extent of incidental is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action."

Should any population of grizzly bears in Montana be delisted, WS-Montana will issue a supplement to this EA analyzing the new management strategy.

3.6.4.2 Canada Lynx

Canada lynx were added to the ESA list of threatened species on March 24, 2000. Populations of Canada lynx in the U.S. are under threat from habitat loss (logging, thinning, and fire suppression), past over-harvest, range expansion by competitors such as bobcats and coyotes, and the intrusion of roads, trails, off-road vehicles, and snowmobiles.

Lynx habitat in Montana mainly occurs in what is considered "Rocky Mountain Conifer Forest", which consists of Douglas fir (*Pseudotsuga menziesii*) and spruce-fir forests above 5,000 ft. elevation in the Rocky Mountains. Montana has over 7.7 million acres that are considered critical Canada lynx habitat; this constitutes over 31% of designated Canada lynx critical habitat in the contiguous United States and is the highest proportion of any state (79 CFR 54782). This habitat is expected to continue to support lynx populations in the near term (U.S. Fish and Wildlife Service 2017b). The biological opinion issued by USFWS determined that WS-Montana's IWDM program was not likely to jeopardize the continued existence of the Canada lynx, and would not affect Canada lynx critical habitat. (Wilson 2009).

A review of MIS database showed that only one Federally Protected lynx has been captured (and subsequently released) since 2000 (Wyoming, 2005) from all APHIS-WS activities on all land classes in the western United States (MIS 2020). There have been no lynx captures by WS-Montana. There was one intentional lethal capture of a non-T&E lynx in Alaska in 2002, as lynx are a federally-listed T&E species only in the contiguous United States.

Risk of adverse effects on lynx from vehicles, firearms, foothold traps, neck snares, foot/leg snares, aerial activities, dogs, M-44's, nets, catch poles, and immobilization drugs is minimal. APHIS-WS has never captured a lynx in Montana and only ever captured one lynx in the Western United States since March 24, 2000. WS-Montana personnel are trained in identification of Canada lynx sign and are knowledgeable of occupied Canada lynx habitat. In known occupied Canada lynx habitat WS-Montana restricts use of baits and attractants that could be desirable to Canada lynx. Pan-tension devices are utilized on foothold traps and foot snares for larger predators (e.g., bears, mountain lions, and wolves) in occupied Canada lynx habitat and reduce the likelihood of capturing Canada lynx and other animals under 35 pounds. M-44 devices are highly selective for canids because the fetid baits that are used are selected for their attractiveness to canids. Also, APHIS-WS Specialists are selective in their choice of placement locations targeting areas frequented by canids. Neck snares used to capture mountain lions and bears pose little to no risk to lynx because the cable loop size is large enough (greater than 12 inches) to preclude capture of lynx. Additionally, APHIS-WS employs the minimization measures found in Section 2.4.

Given the conservation measures implemented by WS-Montana and APHIS-WS' history of very minimal captures, it is extremely unlikely that the proposed IPDM activities would result in a capture. Based on the above information and information presented in the WS Biological Assessment, the USFWS Biological Opinion concluded that the proposed action was not likely to jeopardize the continued existence of the Canada lynx, and would not affect Canada lynx critical habitat in Montana (Wilson 2009). The Biological Opinion stipulates that, in the event that WS-Montana incidentally captures one Canada lynx during the Thirty-five year life of the document, WS-Montana and USFWS will review the circumstances of the events, and determine whether modifications of methods or additional conservation measures are needed to avoid additional take of Canada lynx (Wilson 2009). The reinitiation triggers for consultation established in 50 CFR 402.16 are as follows:

"Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and: 1) the amount or extent of incidental is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action."

3.6.4.3 Wolverines

Wolverines (*Gulo gulo luscus*) were proposed for federal-listing until recently and are state-listed as a species of concern. Wolverine populations in Montana are predominantly located on the western side of the state, based on their preferred habitat of remote wilderness areas (Squires et al. 2007). Wolverine are a Regional Forester Sensitive Species in the USFS Northern Region and a BLM Special Status Species. MFWP currently manages wolverines as a furbearer, however trapping seasons have been suspended and the state take quota is zero.

WS-Montana has regular contact with MFWP field staff and coordinates with MFWP and land management agencies annually in areas where wolverines may occur. WS-Montana personnel are knowledgeable of wolverine sign and identification and are selective in their choice of placement locations of capture equipment. WS-Montana employs the minimization measures found in Section 2.4 and has not captured any wolverines since at least 2005. APHIS-WS has captured five wolverines nationwide since 2004, of which four were released. All five captures occurred in Idaho on high altitude grazing allotments while conducting wolf PDM activities. WS-Idaho has adapted their methods by conducting site assessments to determine wolverine presence prior to placing traps, placing traps away from carcasses, prohibiting use of musky trap lures, and instituting 24-hour trap checks in known wolverine habitat. This has resulted in no additional captures since 2018 (Todd Grimm, WS-Idaho, pers. comm. 02/21/2020).

Given the low number of wolverines present in Montana, low likelihood or duration of working in areas where they have been found in Montana, and no known captures by WS-Montana from FY 2005 – FY 2020, it is unlikely that the proposed IPDM activities would result in an unintentional capture of a wolverine. Should a wolverine be unintentionally captured or killed during PDM activities, WS-Montana will report the incident to MFWP. WS-Montana has also determined that the proposed action is not likely to have any adverse effects on the wolverine population (WS-Montana 2020). Based on the reasons described above, coordination with MFWP and land management agencies, and voluntary implementation of minimization measures (Section 2.4), MFWP concurred with WS-Montana's determination that PDM activities are not likely to adversely affect the long-term conservation of the species in Montana (MFWP Letter of Concurrence, 08/12/2020).

Should wolverines become federally-listed, WS-Montana will issue a supplement to this EA analyzing the new management strategy.

3.6.5 What are the Comparative Impacts of the Alternatives on Threatened and Endangered Species?

3.6.5.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

Impacts on all state- and federally-listed T&E species from WS-Montana IPDM activities are negligible. Since at least 2001, WS-Montana has had no take of state- or federally-listed T&E individuals while conducting IPDM activities (Grizzly bears taken by WS-Montana were taken at the request and under the authorization of USFWS and MFWP, see Section 3.5.11). WS-Montana follows all reasonable and prudent measures and terms and conditions required in the USFWS Biological Opinions for Canada lynx and grizzly bear (USDA Wildlife Services 2018a)(Sections 2.4.1.17, 2.4.2.1). In the Biological Opinions, USFWS determined that the actions as proposed by WS-Montana were not likely to jeopardize the continued existence of the grizzly bear or affect Canada lynx populations, and would not affect Canada lynx critical habitat. MFWP has concurred with WS-Montana's determination that wolverines are not likely to be adversely affected by PDM activities, and cooperated in the development of voluntary protective measures for wolverines. Protective measures are detailed in Sections 2.4.2.1 and 2.4.2.2, and WS Directive 2.310 (Section 2.4.1). In addition, some IPDM activities are conducted by

WS-Montana for the protection of T&E species. WS-Montana would continue to adhere to or update all Section 7 consultations as required by the ESA.

3.6.5.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and resource owners will continue to conduct IPDM activities as described in Section 3.4, with reported take incorporated into the cumulative impact analysis, as in Alternative 1.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but resource owners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Depending on the readiness and interest of other entities to conduct IPDM activities, the cumulative number of predator removals could be greater than, less than, or similar to the cumulative take under Alternative 1. It is possible that more T&E species could be incidentally taken by other entities, as a result of less selective predator removals and lack of protective measures to minimize take of T&E species. Non-federal entities do not complete ESA Section 7 consultations, and it would be difficult to determine what, if any, protective measures were in place by individual landowners to minimize the take of T&E species.

Additionally, T&E species would not benefit from lethal IPDM conducted by WS-Montana for T&E species protection. Other entities may not be trained to identify T&E species and their habitats or be able to conduct lethal IPDM activities to protect T&E species from predation, unless authorized by USFWS.

Because WS-Montana has not taken any T&E species since at least 2001, any increase in take of a T&E species by other entities would have greater adverse effects on T&E species populations compared to the potential adverse effects under Alternative 1.

3.6.5.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. Lethal methods applied by WS-Montana would have similar impacts on T&E species as those analyzed under Alternative 1. Non-lethal methods implemented by WS-Montana would not adversely affect T&E species. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's non-lethal assistance, resource owners could still choose to address the problem themselves. If resource owners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Resource owners could use trained and experienced WCOs or may implement lethal methods themselves. However, entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Non-federal entities do not complete ESA Section 7 consultations, and it would be difficult to determine what, if any, protective measures were in place by individual resource owners to minimize the take of T&E species. Other entities may not be trained to identify T&E species and their habitats or be able to conduct lethal IPDM activities to protect T&E species from predation, unless authorized by USFWS.

Because WS-Montana has not taken any T&E species since at least 2001, any increase in take of a T&E species by other entities would have greater adverse effects on T&E species populations compared to the potential adverse effects under Alternative 1.

3.6.5.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety or federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. All predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. When WS-Montana responds with lethal control of predator species under the limited circumstances allowable under this alternative, the impacts on T&E species from WS-Montana would be less than those described for Alternatives 1 and 3, because fewer predators are removed under this alternative. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

WS-Montana would not be able to respond with lethal methods to damage or threats to any other resources or situations. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Non-federal entities do not complete ESA Section 7 consultations, and it would be difficult to determine what, if any, protective measures were in place by individual landowners to minimize the take of T&E species. Other entities may not be trained to identify T&E species and their habitats or be able to conduct lethal IPDM activities to protect T&E species from predation, unless authorized by USFWS.

Because WS-Montana has not taken any T&E species since at least 2001, any increase in take of a T&E species by other entities would have greater adverse effects on T&E species populations compared to the potential adverse effects under Alternative 1.

3.6.5.5 Alternative 5. No WS-Montana IPDM Activities

WS-Montana would have no effect on T&E species under this alternative. T&E species would not benefit from IPDM conducted by WS-Montana for T&E species protection. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Non-federal entities do not complete ESA Section 7 consultations, and it would be difficult to determine what, if any, protective measures were in place by individual landowners to minimize the take of T&E species. Other entities may not be trained to identify T&E species and their habitats or be able to conduct lethal IPDM activities to protect T&E species from predation, unless authorized by USFWS.

Because WS-Montana has not taken any T&E species since at least 2001, any increase in take of a T&E species by other entities would have greater adverse effects on T&E species populations compared to the potential adverse effects under Alternatives 1-4.

Furthermore, other entities may not be able to conduct lethal IPDM activities to protect T&E species from predation, unless authorized by USFWS.

3.7 What are the Effects on Species that WS-Montana May Take Unintentionally?

Between FY 2013 and FY 2017, WS-Montana unintentionally captured an average of 16 animals per year during IPDM activities. Of those animals unintentionally captured, an average of 10.4 animals per year were killed and an average of 5.6 animals per year were released (Table 3.19). Therefore, approximately 35% of unintentional captures result in the release of the animal. A large proportion (68%) of the animals that were killed unintentionally were striped skunks, porcupines, and red fox, captured mostly in foothold traps and neck snares. WS-Montana's unintentional captures are less than 1% of the total (intentional and unintentional) captures while conducting IPDM between FY 2013-FY

2017. Unintentional lethal take is only 0.15% of the total take during IPDM activities, indicating that the methods and procedures used are highly selective for target species.

Use of best management practices (Section 3.9.4), including knowledge of target and non-target species, familiarity with the habitat selection by species, selectivity of traps and lures, all combine to minimize the risk of take of non-target species.

For each unintentionally captured species, the average number of animals that WS-Montana captured during IPDM activities from FY 2013 through 2017 is listed below. The capture methods and the percentage of unintentional capture compared to total take is summarized. As discussed in Section 3.5, WS-Montana occasionally unintentionally kills other predator species when targeting specific predators, and occasionally has unintentional lethal take of non-predator species.

Black Bears. On average, 2.2 black bears per year were captured unintentionally in traps or foot snares. All black bears unintentionally captured during the five-year period were freed or relocated. Unintentional lethal take of black bear was 0% of WS-Montana's total black bear take.

Striped Skunks. On average, 2.8 striped skunks per year were captured unintentionally in foothold traps or neck snares, and euthanized. Given low intentional take of this species, WS-Montana's unintentional lethal take of striped skunks was 23% of total striped skunk take.

Raccoons. On average, 0.4 raccoons per year were captured unintentionally in neck snares and euthanized. Unintentional lethal take of raccoons was 8% of WS-Montana's total raccoon take.

Mountain Lions. On average, 0.4 mountain lions per year were captured unintentionally in foothold traps and neck snares and freed. Unintentional lethal take of mountain lions was 0% of WS-Montana's total mountain lion take.

Red Foxes. On average, 2 red fox per year were captured unintentionally in foothold traps or neck snares and euthanized or taken unintentionally using M-44s. Unintentional lethal take of red fox was 1.1% of WS-Montana's total red fox take.

Badgers. On average, 0.8 badgers per year were captured unintentionally in foothold traps or neck snares and euthanized. On average, 0.4 badger per year were caught in foothold traps and were freed. Unintentional lethal take of badger was 9.3% of WS-Montana's total badger take.

Bobcats. On average, 0.2 bobcats per year were captured unintentionally in neck snares and euthanized. Given low intentional take of this species, WS-Montana's unintentional lethal take of bobcats was 50% of total bobcat take.

Feral/free-ranging Dogs. On average, 0.6 feral/free-ranging dogs per year were taken unintentionally using M-44s. An average of 1.2 feral/free-ranging dogs per year were captured unintentionally in foothold traps or neck snares and freed or transferred to another entity.

Gray Wolves. On average, 0.4 gray wolves were captured unintentionally using foothold traps and euthanized or unintentionally taken using M-44s. Unintentional lethal take of gray wolves was 0.76% of WS-Montana's total gray wolf take.

Coyotes. WS-Montana did not capture or take any coyotes unintentionally during the five-year period.

Ravens. WS-Montana did not capture or take any ravens unintentionally during the five-year period.

Feral Cats. WS-Montana did not capture or take any feral cats unintentionally during the five-year period.

Feral Swine. WS-Montana did not capture or take any feral swine unintentionally during the five-year period.

Grizzly Bears. WS-Montana did not capture or take any Grizzly bears unintentionally during the five-year period. One grizzly bear was captured in a foot hold trap set for wolf damage management in August 2019, it was subsequently released unharmed and USFWS was notified of the event.

Non-predators. On average, 3.2 non-predator species were taken per year between FY 2013 and FY 2017. The animals taken were porcupines (an average of 2.4 per year) and white-tailed deer (an average of 0.8 per year) and were captured in neck snares. The average number of non-predators unintentionally captured and freed per year was 1.4 during the five-year period. These consisted of moose, pronghorn, pets or livestock (these are not differentiated in the MIS database), and porcupines.

3.7.1 What are the Comparative Impacts of the Alternatives on Populations of Animals Taken Unintentionally?

3.7.1.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

WS-Montana lethally takes a small number of animals unintentionally each year, an average of 10.4 animals, with an additional 5.6 animals captured and freed (Table 3.18). Under the Proposed Action, WS-Montana would be expected to continue to have a similar minimal level of unintentional take each year. WS-Montana would continue to use the same protective measures outlined in this EA (Section 2.4). Unintentional predator take was evaluated in Section 3.5 as part of the cumulative effects analysis. Non-predator unintentional take is so low as to be negligible, especially because the species unintentionally taken are abundant in Montana.

WS-Montana's IPDM activities are highly selective for predatory animals, and as shown in Sections 3.7 and 3.5, unintentional take is expected to remain negligible.

3.7.1.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners would be expected to continue to conduct IPDM activities as described in Section 3.4. WS-Montana would anticipate having close to no unintentional take under this alternative, however there is always a minimal potential for unintentional take when using non-lethal methods.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others in minimizing unintentional captures, the number of animals unintentionally killed could be greater than, less than, or similar to the unintentional take under Alternative 1. It is possible that more animals could be taken unintentionally by other entities, as a result of less selective removal efforts. Conversely, fewer animals may be unintentionally removed in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, and because individuals experiencing damage may not take action themselves.

Although it is not possible to determine how many additional animals would be taken unintentionally by entities other than WS-Montana, it is assumed that WCOs would take few animals unintentionally, similar to that of WS-Montana. However, landowners or private entities may unintentionally take more animals than WS-Montana or WCOs would due to having less proficiency in the range of methods and being less selective with their use. In addition, many of the protective measures used by WS to minimize adverse effects (Section 2.4) may not be implemented by private individuals. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1.

Therefore, there is a potential for higher levels of unintentional take by other entities, compared to Alternative 1. However, because the predator and non-predator species are generally resilient and below the current annual maximum sustainable harvest level (Section 3.5), the populations of unintentionally taken animals are expected to remain stable.

3.7.1.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. WS-Montana would likely take slightly fewer individuals compared to Alternative 1. Non-lethal methods would not likely contribute to an unintentional lethal effect on animals. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees, increasing the risk of unintentionally taking animals.

Therefore, there is a potential for higher levels of unintentional take by other entities, compared to Alternative 1. However, because the predator and non-predator species are generally resilient and below the current annual maximum sustainable harvest level (Section 3.5), the populations of unintentionally taken animals are expected to remain stable.

3.7.1.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, or federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to

T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. Because operational lethal actions would be limited and not available to manage damage to other resources, WS-Montana would likely take fewer predators than under Alternative 1, and thus there would be less potential for unintentional take. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

However, WS-Montana would not be able to respond with lethal methods to damage or threats to any other resources or situations. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees, increasing the risk of unintentionally taking animals.

Therefore, there is a potential for higher levels of unintentional take by other entities, compared to Alternatives 1 and 3. However, because the predator and non-predator species are generally resilient and below the current annual maximum sustainable harvest level (Section 3.5), the populations of unintentionally taken animals are expected to remain stable.

3.7.1.5 Alternative 5. No WS-Montana IPDM Activities

WS-Montana would have no unintentional take of individual animals under this alternative. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees, increasing the risk of unintentionally taking animals.

Therefore, there is a potential for higher levels of unintentional take by other entities, compared to Alternatives 1-4. However, because the predator and non-predator species are generally resilient and below the current annual maximum sustainable harvest level (Section 3.5), the populations of unintentionally taken animals are expected to remain stable.

Table 3.19. Animals unintentionally captured during WS-Montana IPDM activities by method, FY 2013- FY 2017.

Unintentional take- Killed[1]								
Species	Foothold traps	Neck snares	M-44	Cage traps	Culvert traps	Foot snares	5-year total by species	5-year average by species
Striped skunk	5	9	-	-	-	-	14	3.4
Raccoon	-	2	-	-	-	-	2	0.4
Red Fox	2	5	3	-	-	-	10	2
Badger	2	2	-	-	-	-	4	0.8
Bobcat	-	1	-	-	-	-	1	0.2
Feral/free-ranging dog	-	-	3	-	-	-	3	0.6
Gray Wolf	1	-	1	-	-	-	2	0.4
Porcupine	12	-	-	-	-	-	12	2.4
White-tailed deer	-	4	-	-	-	-	4	0.8
5-year total by method	22	23	7	-	-	-	52	-
5-year average by method	4.4	4.6	1.4	-	-	-	10.4	-
Unintentional take- Freed/relocated/transfer of custody								
Species	Foothold traps	Neck snares	M-44	Cage traps	Culvert traps	Foot snares	5-year total by species	5-year average by species
Badger	2	-	-	-	-	-	2	0.4
Feral/free-ranging dog	3	3	-	-	-	-	6	1.2
Black bear	5	-	-	1	1	4	11	2.2
Pet/livestock	1	-	-	-	-	-	1	0.2
Mountain Lion	1	1	-	-	-	-	2	0.4

Porcupine	1	1	-	-	-	-	2	0.4
Moose	-	1	-	-	-	-	1	0.2
Pronghorn	2	1	-	-	-	-	3	0.6
5-year total by method	15	7	-	1	1	4	28	-
5-year average by method	3	1.4	-	0.2	0.2	0.8	5.6	-
Unintentional take- All								
5-year grand total by method	37	30	7	1	1	4	80	-
5-year grand average by method	7.4	6	1.4	0.2	0.2	0.8	16	-

[1] No predator species were unintentionally captured and killed during WS-Montana non-IPDM activities.

3.8 What is the Potential for WS-Montana IPDM Activities to Result in Ecological Trophic Cascades in Montana?

3.8.1 Introduction

Trophic cascades are indirect species interactions that originate with predators and spread downward through food webs (Ripple et al. 2016). In a simple example, predators, their herbivore prey, and plants that provide food for herbivores are three trophic levels that interact in a food web. Some members of the public are concerned that APHIS-WS' activities which remove top (or apex) predators will create the conditions for trophic cascade by reducing the predation pressure on lower trophic levels, including plant communities. Apex predators can be defined as species that feed at or near the top of the food web of their supporting ecosystem and that are relatively free from predation themselves once they reach their adult size (Sergio et al. 2014), such as grizzly bears, gray wolves, mountain lions, black bears, and coyotes in Montana. The concern is that species in lower trophic levels could then take on new ecosystem roles, possibly having negative effects on other species and habitats (Appendix F). Concerns have been focused primarily on the potential for trophic cascades to occur due to predator removals to protect livestock. For example, decreasing apex predators could reduce pressure on herbivore populations, which in turn overexploit vegetation and effect water quality.

WS-Montana does not dispute the significance of the ecological role played by predators. APHIS-WS shares concerns with the public and scientific community for the integrity of ecological systems in which we live, work, and recreate. APHIS-WS utilizes measures to protect ecosystem integrity and minimize adverse effects of IPDM by focusing IPDM on specific individuals or localized groups (Sections 1.12.3 & 2.4).

Our analysis, however, indicates that the IPDM activities evaluated in this EA are not expected to cause trophic cascades. This section will discuss why WS-Montana IPDM activities do not affect predator populations in Montana and therefore are unlikely to create trophic cascades.

APHIS-WS has reviewed concerns that have been commonly raised by the public during similar APHIS-WS NEPA processes (USDA Wildlife Services 2011;2014a;2016) and by some authors (Bergstrom et al. 2014) that its activities might disrupt ecosystems and cause trophic cascades by eliminating or substantially reducing top predators. Consequently, we reviewed pertinent scientific literature on the subject to consider as part of the analysis of this issue (e.g., Ballard et al. 1997, Stenseth et al. 1997, Halaj and Wise 2001, Terborgh et al. 2001, Wilmers et al. 2003, Schmitz et al. 2004, Hebblewhite et al. 2005, Ripple and Beschta 2006;2007, Berger et al. 2008, Kauffman et al. 2010, Brown and Conover 2011, Estes et al. 2011, Ripple et al. 2011, Beschta and Ripple 2012, Levi and Wilmers 2012, Ripple and Beschta 2012, Squires et al. 2012, Callan et al. 2013, Marshall et al. 2013, Sergio et al. 2014, Painter et al. 2015, Ripple et al. 2015, Ripple et al. 2016, Allen et al. 2017, Benson et al. 2017, Engeman et al. 2017).

A summary of relevant scientific publications on trophic cascade research and related topics is in Appendix F. The results of the literature review, combined with the analyses of potential direct and cumulative impacts to populations of predator species (Section

3.5), provides the basis for WS-Montana's conclusion that IPDM activities are highly unlikely to cause trophic cascades in Montana.

3.8.2 What are the Relevant Scientific Concepts and Studies for Understanding Trophic Cascades?

The science associated with the study of trophic cascades is relatively new, and is based primarily on freshwater aquatic, marine intertidal, and terrestrial grassland and crop-dominated ecosystems. Only recently has trophic cascade research been focused on understanding coyote and wolf responses to predator control (e.g., Berger and Gese 2007, Ripple et al. 2013). Studies suggest that different ecosystems respond dissimilarly to changes in apex predator populations for many reasons, including the inherent variability in and different levels of productivity of terrestrial, aquatic, and marine ecosystems; the number of ecological interactions and interrelationships among predators and prey within a food web; the ability of animals to move into and out of a particular area (an open system), which affects to the food web are being studied; whether a predator may also eat plants; and whether a predator may eat individuals of another predator species, such as coyotes eating foxes within a trophic food web (e.g., Pace et al. 1999, Borer et al. 2005, Vance-Chalcraft et al. 2007, Ripple et al. 2016).

Recently, Winnie and Creel (2017) reviewed literature related to trophic cascades, concluding that predators exert significant pressure on prey species both killing prey and altering their behaviors. This pressure is exerted through 2 mechanisms – behavior mediated trophic cascades and density mediated trophic cascades. Behavior mediated trophic cascade are the result of a predator altering prey behavior. However, the study (Winnie and Creel 2017) indicates that behaviorally mediated trophic cascades are not likely to occur in systems with coyotes or wolves because those predators are highly mobile and only cause temporary changes in prey behavior, not chronic ones. Because the effects of the proposed PDM are likely to result in temporally short, localized reductions in predators (Section 3.5), prey populations are unlikely to experience significant changes in stressors that would result in a behavior mediated trophic cascades.

Winnie and Creel (2017) also expressed concern that cases where there were no behavior mediated trophic cascades (BMTC) occurring were underrepresented in the literature. The authors stated:

> *"Thus data from places were a BMTC is not occurring, but the hypothesis predicts one should be occurring, are considered uninformative and excluded from consideration. This approach is not in keeping with the scientific method, nor with accepted practices in hypothesis testing, and illustrates the necessity of revisiting fundamental principles of logic during the design phase of studies."*

Conversely, Winnie Jr and Creel (2017) stated that density mediated trophic cascades are well supported by studies. Density mediated trophic cascades occur where predators affect prey populations through consumption. Density mediated trophic cascades have been documented in areas where the prey base is naïve to new predators, such as the elk in Yellowstone when wolves were reintroduced to the ecosystem. When a predator is introduced, the predator-naïve population is more likely to be depleted because they do not know how to avoid predation until they adapt. This can result in a density mediated trophic cascade if the predators are able to take advantage of the prey's naivety (Wood et al. 2020). Where the prey-base is predator savvy, prey will modify their behavior, preventing significant population shifts. The complete removal of a predator species is not the goal of PDM, and will not occur under any of the alternatives analyzed in Section 3.5, 3.6, and 3.7. Therefore, Montana lacks a truly predator naïve prey population that would be susceptible to density mediated trophic cascades.

The study of trophic cascades is complex, and includes the following concepts:

- **Intraguild predation** (IGP), which broadened the trophic relationships from vertical chains sometimes involving shared prey, to include horizontal relationships where predators kill and sometimes eat other predators in what became known as a food web rather than a food chain (e.g., Polis et al. 1989, Palomares et al. 1995, Litvaitis and Villafuerte 1996, Palomares et al. 1996, Arim and Marquet 2004, Finke and Denno 2005, Berger and Gese 2007, Daugherty et al. 2007; Appendix F.8.1);
- **Mesopredator release** (MPR), a concept in which the suppression or removal of historical top predators may release populations of smaller predators, such as foxes, raccoons, or often coyotes, which may have different impacts on the ecosystem (e.g., Crooks and Soule 1999, Prugh et al. 2009, Ritchie and Johnson 2009, Roemer et al. 2009, Brashares et al. 2010, Ripple et al. 2013, Allen et al. 2014, Allen et al. 2018; Appendix F.8.2);
- **Adaptive behavior** of individuals or groups of prey species to reduce the risk of predation, such as changing habitat use, social structure, and time of certain activities (e.g., Gese et al. 1996a;b, Gese 1998;1999, Kitchen et al. 2000, Schmitz et al. 2004, Peckarsky et al. 2008, Wallach et al. 2009, Wilson et al. 2010, Berger-Tal et al. 2011; Appendix F.9.1);
- **Resource partitioning**, wherein predators and prey avoid each other by using different portions of the same habitat, often due to **competitive exclusion** when two species have similar diets or habitats, causing one species to interfere with the ability of the other to use those resources (e.g., Polis et al. 1989, Arjo et al. 2002, Wilmers et al. 2003, Finke and Denno 2005, Gehrt and Prange 2006, Atwood et al. 2007, Brook et al. 2012, Lendrum et al. 2014; Appendix F.9.2);
- **Ecosystem resilience**, the ability of ecosystems to rebound to previous conditions after a major impact or disruption, such as from a wildfire, major weather even, removal of a species, or introduction of an invasive species (e.g., Hooper et al. 2005, Srivastava and Vellend 2005, Balvanera et al. 2006, Casula et al. 2006, Duffy et al. 2007, Cleland 2011, Ritchie et al. 2012; Appendix F.11);
- **Ecosystem services**, wherein ecosystems provide sustainable ecological services to humans, such as food, crop pollination, clean water, and clean air (e.g., Duffy 2003, Hooper et al. 2005, Srivastava and Vellend 2005, Balvanera et al. 2006, Dobson et al. 2006, Duffy et al. 2007, Cleland 2011; Appendix F.11).

Most of the literature is not highly applicable to understanding trophic cascades and contributing processes as they relate to large terrestrial predators because of differences in ecosystems, challenges to conducting and interpreting research of complex and dynamic ecological systems, or serious discrepancies in the study design or conclusions (Appendix F). Researchers have questioned the capability of these studies to be scaled up to larger-scale ecosystems and more complex ecological trophic structures (Borer et al. 2005, Ray et al. 2005a, Ripple and Beschta 2006, Vance-Chalcraft et al. 2007, Engeman et al. 2017). Additionally, what we understand in about these complex systems is changing and improving. Mech (2012) stated, "science is self-correcting" remarking that researchers review or build upon others research has the advantage of scrutinizing and improve upon their predecessor's work.

With large free-ranging carnivores, intended removal of predators as part of a study is typically socially, ethically, and politically challenging or impossible (Ray et al. 2005a, Estes et al. 2011, Engeman et al. 2017). Therefore, many studies rely on areas in which large apex predators were extirpated and either were reintroduced or rapidly recolonized the area, while the original conditions remain substantially the same, such as in older national parks, including Yellowstone National Park, Zion NP, and Banff NP (e.g., Hebblewhite et al. 2005, Ripple and Beschta 2006, Berger et al. 2008, Estes et al. 2011, Beschta and Ripple 2012, Ripple et al. 2015). However, to the extent that these areas can be used to research these complex systems, national parks comprise a small portion of the ecosystem, and that if those ecological effects are found, they don't necessarily apply everywhere else (Muhly et al. 2010, Mech 2012).

Many apex predator species have experienced dramatic range contractions. Their eradication is believed to have trophic impacts on the ecosystems in which they occur, especially through the phenomenon of mesopredator release (Crooks and Soule 1999, Prugh et al. 2009, Roemer et al. 2009, Brashares et al. 2010, Miller et al. 2012). The presence of predators causes reductions in the prey population or cause the prey population to alter its habitat use. In turn, changes in prey behaviors impact plant community composition and health (Terborgh et al. 2001, Beschta and Ripple 2012, Ripple and Beschta 2012). Depending on the nature of the impact and the prey species, changes in vegetation and prey behavior can have impacts on abiotic factors such as soil compaction, soil nutrients, and river morphology (Naiman and Rogers 1997, Ripple and Beschta 2006). In the Midwest, changes in coyote activity impacted white-tailed deer activity, with associated impacts to plant communities (Waser et al. 2014).

However, as with most ecosystems, the nature and magnitude of these types of relationships varies. For example, Maron and Pearson (2011) did not detect evidence that the presence of vertebrate predators fundamentally affected primary production or seed survival in a grassland ecosystem. Similarly, Kauffman et al. (2010) found that predation risk on herbivores alone is unlikely to alter the survivorship of plant communities, but predation in combination with site productivity and abiotic factors, such as soil moisture, mineral content, or snow accumulation, may allow for landscape-level recovery of vegetation.

3.8.3 What is the Risk that WS-Montana IPDM Activities May Result in Trophic Cascades?

Most evaluations of the impacts of predator removal or loss on biodiversity involve complete removal over the course of years (e.g., Ripple and Beschta 2006, Berger et al. 2008, Ripple et al. 2016). APHIS-WS does not strive to eliminate or remove native predators from any area on a long-term basis. When direct management of depredating animals is deemed legal, necessary, and desirable, efforts focus on management of the specific depredating animal or local group of animals. Consequently, no predators or prey would be extirpated and none would be introduced into an ecosystem.

APHIS-WS operates on relatively small portions of properties, over relatively short periods, and in accordance with federal and state laws and regulations. APHIS-WS impacts are generally temporary due to natural immigration and reproduction of predators. Additionally, take of predator species are in relatively small or isolated geographic areas in comparison with the overall population. APHIS-WS only conducts activities when and where it is permitted, needed, and requested by cooperators or the public. Because APHIS-WS' actions do not result in long-term extirpation or eradication of any native wildlife species, the findings of most of these studies are not relevant.

Some studies indicate that the conditions necessary for a trophic cascades may require the drastic reduction or complete collapse of apex predator populations (e.g., Brashares et al. 2010, Ripple et al. 2011, Beschta and Ripple 2012). WS-Montana works closely with state and federal wildlife managers and landowners to assure that cumulative take of native target and non-target species is managed at levels that would not have significant impacts on wildlife populations, including those of apex predators. Current APHIS-WS activities do not result in the direct or indirect loss of any wildlife species population or sustained reduction in predator population densities.

WS-Montana's take of potential apex predator species (i.e., bears, wolves, mountain lions, and coyotes) is small compared with broader populations of those species. The cumulative take of bears, wolves, mountain lions, and coyotes in Montana, respectively, (Section 3.5; Tables 3.9, 3.13, 3.6, 3.7, and 3.2) is below that of the annual maximum sustainable harvest level for each species. WS-Montana's take for each species is a lower proportion of the cumulative take than non-WS take sources reported to MFWP and MDOL.

Because WS-Montana does not have significant effects on target and non-target species populations (Sections 3.5 to 3.7), there is no potential for the elimination of apex predators or other native species, and the conditions to precipitate a trophic cascade are not produced. The limited nature of WS predator take is so low that substantive long-term shifts in population age structure do not generally occur (Section 3.5).

3.8.4 What are the Comparative Impacts of the Alternatives on Ecological Trophic Cascades?

3.8.4.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

APHIS-WS continues to acknowledge the important ecological role played by predators. However, due to the targeted nature of predator removals (Sections 2.3.1.7 and 3.5.1), including short duration, small geographic scope, and low proportion of take compared with the populations, the localized IWDM activities explored in this EA are not expected to change this balance. The effects of WS-Montana activities are therefore temporary, localized, and of low magnitude (Section 3.5). Negative population-level effects on apex predators from APHIS-WS are very unlikely because predator populations are stable under the current and projected levels of cumulative take (Section 3.5.16).

Therefore, under Alternative 1, it is highly unlikely that WS-Montana's current and projected direct and cumulative take (Table E.1) is contributing to any ecologically-forced trophic cascades, mesopredator releases, and any resulting adverse ecological effects on biodiversity, ecosystem resilience, or ecosystem services.

3.8.4.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners would be expected to continue to conduct IPDM activities as described in Section 3.4. WS-Montana would have no take under this alternative.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the readiness and interest of other entities to conduct IPDM activities, the cumulative number of predator removals could be greater than, less than, or similar to the cumulative take under Alternative 1. It is possible that more animals could be taken by other entities, as a result of less selective removals effort. Conversely, fewer animals may be removed in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, and because individuals experiencing damage may not take action themselves. Lastly, there is the potential for predators to be removed by other entities at a similar level to WS-Montana's lethal take under Alternative 1.

Under Alternative 2, other entities would be expected to have a higher level of take compared to Alternative 1. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. However, take by other entities would not be expected to near annual maximum sustainable harvest levels established for the predator species, despite any reasonably foreseeable levels of increased take by other entities.

Therefore, under Alternative 2, there is no potential for WS-Montana to initiate a trophic cascade. Additionally, it is highly unlikely that take by other entities will contribute to any ecologically-forced trophic cascades, mesopredator releases, and any resulting adverse ecological effects on biodiversity, ecosystem resilience, or ecosystem services.

3.8.4.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. Lethal methods applied by WS-Montana would have slightly less take of predator populations as compared to Alternative 1. Non-lethal methods would have negligible impacts on predators. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would be likely to continue to conduct IPDM activities as described in Section 3.4.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. However, entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees.

Under Alternative 3, predator populations are expected to remain stable with similar levels of take by other entities as under Alternative 1. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. However, cumulative take would not be expected to near annual maximum sustainable harvest levels established for the predator species, despite any reasonably foreseeable levels of increased take by other entities.

Therefore, under Alternative 3, there is no potential for WS-Montana to initiate a trophic cascade. Additionally, it is highly unlikely that cumulative take will contribute to any ecologically-forced trophic cascades, mesopredator releases, and any resulting adverse ecological effects on biodiversity, ecosystem resilience, or ecosystem services.

3.8.4.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, or federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, wolves, mountain lions, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. When WS-Montana responds with lethal control under the limited circumstances allowable under this alternative, the impacts on predator populations from WS-Montana would be less than those described for Alternatives 1 and 3, because fewer predators are removed under this alternative. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, WS-Montana would not be able to respond with lethal methods to damage or threats to any other resources or situations. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1.

Under Alternative 4, predator populations are expected to remain stable with higher levels of take by other entities compared to Alternative 1. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. However, cumulative take would not be expected to near annual maximum sustainable harvest levels established for the predator species, despite any reasonably foreseeable levels of increased take by other entities.

Therefore, under Alternative 4, there is no potential for WS-Montana to initiate a trophic cascade. Additionally, it is highly unlikely that cumulative take will contribute to any ecologically-forced trophic cascades, mesopredator releases, and any resulting adverse ecological effects on biodiversity, ecosystem resilience, or ecosystem services.

3.8.4.5 Alternative 5. No WS-Montana IPDM Activities

Under this alternative, WS-Montana would have no effect on predator populations or the potential to initiate a trophic cascade. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. Take of unprotected mammals by private individuals or their agent is not required to be reported to MFWP, potentially resulting in underreporting, compared to WS-Montana's reporting under Alternative 1. However, while take by other entities would be higher than under Alternatives 1-4, cumulative take would not be expected to near annual maximum sustainable harvest levels established for the predator species, despite any reasonably foreseeable levels of increased take by other entities.

Therefore, under Alternative 5, there is no potential for WS-Montana to initiate a trophic cascade. Additionally, it is highly unlikely that cumulative take will contribute to any ecologically-forced trophic cascades, mesopredator releases, and any resulting adverse ecological effects on biodiversity, ecosystem resilience, or ecosystem services.

3.9 How Do Wildlife Professionals and Others Consider Ethics and Humaneness in Predator Damage Management?

WS-Montana takes ethics and humaneness seriously. The science of wildlife biology and management, including IWDM and wildlife research, often involves directly capturing, handling, physically marking, taking samples from, and, at times, lethally removing free-ranging animals. These actions can cause stress, pain, and sometimes inadvertent injury to the individual animals (e.g., Kreeger et al. 1990, Powell and Proulx 2003, Vucetich and Nelson 2007, Sneddon et al. 2014). WS-Montana personnel strive to undertake these activities as ethically and humanely as possible under field conditions.

3.9.1 What are the Ethics and Attitudes about Wildlife Damage Management?

Ethics are standards of human conduct. The management of wildlife, especially if it involves lethal actions, can elicit varied emotional reactions, depending somewhat on geographic location and species, and these reactions can change over time (Littin et al. 2004, Haider and Jax 2007). The degree of interaction with natural resources appears to be a factor influencing value systems regarding wildlife (Section 1.4.2).

Humaneness is most often related to human interactions with wildlife, especially when humans kill, capture, or otherwise directly interact with animals. However, humaneness also pertains to human suffering caused by wildlife directly hurting or impacting them. In addition, some people are highly concerned with suffering caused by predation on wildlife and domestic animals, including horses, livestock guard animals, and pets. People have bred many of the defensive capabilities out of domestic animals and may feel it is unethical and inhumane not to effectively protect them from predation, as predators can have very inhumane killing techniques where animals are injured or fed upon prior to or without being killed. Additionally, humaneness is not always present in nature. Even if uninfluenced by human actions, animal populations and individual animals experience natural mortality factors from predation, accidents, weather, disease, mortality of young, habitat degradation from overuse, and malnutrition. Wildlife populations reproduce at greater rates than necessary to replace deaths if all individuals died from old age. Most populations fluctuate around a habitat-driven density, called the carrying capacity. Populations that approach or overshoot this density become more sensitive to many sources of mortality (Section 3.8).

People's concern with humaneness falls on a spectrum. Schmidt (1989) and Bekoff (2002) define advocates of "animal rights" as those who often place priority on individual animals, ranking animal rights as morally equal to human rights. These advocates believe that animals should not be used for human benefits (such as research, food, recreational use such as hunting and trapping, being displayed in zoos, protecting livestock or even being livestock, being used for laboratory research, or protecting natural resources from wildlife damage), unless that same action is morally acceptable when applied to humans. Advocates of "animal welfare" are those who are concerned with the welfare of animals in relation to human actions involving those animals, such as the level of suffering of individual animals, while recognizing that human benefits may sometimes justify costs to animals, such as the use of animals for research or food. Advocates for animal welfare believe that humans are obligated to manage animal populations to minimize animal suffering, especially when ecological imbalances are caused by human actions (Varner 2011). As with most things, people have a range of attitudes and beliefs from one end of the spectrum to the other (Section 1.4.2).

3.9.2 How are Euthanasia and Humane Killing Defined?

APHIS-WS policy and operations comply with the guidelines of the American Veterinary Medical Association (American Veterinary Medical Association 2020), which defines euthanasia as "…ending the life of an individual animal in a way that minimizes or eliminates pain and distress" and states that "...if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible". This typically involves unconsciousness followed by cardiac or respiratory arrest, leading to loss of brain function, with minimized stress and discomfort prior to the animal losing consciousness.

The American Veterinary Medical Association (2020) recognizes that there is "an inherent lack of control over free-ranging wildlife, accepting that firearms may be the most appropriate approach to their euthanasia, and acknowledging that the quickest and most humane means of terminating the life of free-ranging wildlife in a given situation may not always meet all criteria established for euthanasia." In other words, the AVMA distinguishes between euthanasia, typically conducted on a restrained animal, and methods that are more accurately characterized as humane killing of unrestrained animals under field conditions.

Furthermore, classification of a given method as a means of euthanasia or humane killing may vary by circumstances and species. These acknowledgments are not intended to condone a lower standard for the humane euthanasia of wildlife. The best methods possible under the circumstances must be applied, and new technology and methods demonstrated to be superior to previously used methods must be embraced. The American Veterinary Medical Association (2020) states that in field cases where sophisticated equipment is not available, the only practical means of killing an animal may be using a lethal method of trapping or, if the animal is captured, still alive, and cannot or should not be released, or is unrestrained in the wild, a killing gunshot. The American Veterinary Medical Association (2020) states that personnel should be proficient and should use the proper firearm, ammunition, and trap for the species.

The American Veterinary Medical Association (2020) also notes, "…it may still be an act of euthanasia to kill an animal in a manner that is not perfectly humane or that would not be considered appropriate in other contexts. For example, due to lack of control over free-ranging wildlife and the stress associated with close human contact, use of a firearm may be the most appropriate means of euthanasia. Also, shooting a suffering animal that is in extremis, instead of catching and transporting it to a clinic to euthanize it using a method normally considered to be appropriate (e.g., barbiturates), is consistent with one interpretation of a good death. The former method promotes the animal's overall interests by ending its misery quickly, even though the latter technique may be considered to be more acceptable under normal conditions. Neither of these examples, however, absolves the individual from her or his responsibility to ensure that recommended methods and agents of euthanasia are preferentially used."

As described by the American Veterinary Medical Association (2020), there may be a distinction between clinical euthanasia and field practices for humane killing, but field practices are still considered an acceptable form of euthanasia. APHIS-WS policy and operating procedures fully comply with these guidelines, and APHIS-WS recognizes the importance of careful decision making in the field regarding all use of lethal methods.

3.9.3 How are Pain and Suffering Evaluated?

Animal suffering is often considered in terms of physical pain, physiological and emotional stress, and tissue, bone, and tooth damage that can reduce future survivability and health (Sneddon et al. 2014). Injury to an animal caused by trapping can range from losing a claw, breaking a tooth, tissue damage, and wounds, to bone fractures and death (Olsen et al. 1986, Onderka et al. 1990, Gruver et al. 1996, Engeman et al. 1997, International Organization for Standardization 1999). However, the conditions of physical trauma, such as the location of the wound, whether the animal is young, old, with young, female or male, can affect the long-term fecundity and survival when released (Iossa et al. 2007).

Assessing pain experienced by animals can be challenging (California Department of Fish and Game 1991, American Veterinary Medical Association 2020). American Veterinary Medical Association (2020) states "The perception of pain based on mammalian models requires nerve impulses from peripheral nociceptors to reach a functioning conscious cerebral cortex and the associated subcortical brain structures". Because we cannot directly ask an animal about its pain, and even humans have different pain thresholds and have difficulty communicating a particular level of pain, it is difficult to quantify the nebulous concept of pain and suffering (Putman 1995).

Stress has been defined as the effect of physical, physiologic or emotional factors (stressors) that induce an alteration in an animal's base or adaptive state. Responses to stimuli vary among animals based on the animals' experiences, age, species and current condition. Not all forms of stress result in adverse consequences for the animal and some forms of stress serve a positive, adaptive function for the animal (American Veterinary Medical Association 2020). It is the intent of professional IPDM practitioners to minimize distress in animals to the maximum extent practicable.

Pain, anxiety, and stress caused by restraint and physical exertion due to struggling to escape can manifest physiologically through the sympathetic nervous system and interplay among hormones produced by the hypothalamus, pituitary and adrenal glands. Pain and stress can be measured through short-term increases in cortisol from the adrenal glands, heart rate, blood pressure, body temperature, and breathing rate, and a long-term loss of body weight. Kreeger et al. (1990) found that the physiological and hormonal stress indicators in trapped red fox occurred during the first two hours of capture. The authors assumed that these indicators were caused by anxiety, pain, fear, physical exertion, either individually or in combination. After two hours of capture, in which the animal was in "fight or flight" stress reaction, bouts of struggle became intermittent, resulting in a "conservation/withdrawal" reaction in which the animal was in a calmer state. The authors also found that padded traps caused less physical and physiological trauma than unpadded traps when traps were checked between four and eight hours after setting.

Although humans cannot be fully certain that animals can experience pain-like states, assuming that animals can suffer pain ensures that we take appropriate steps to minimize that risk and treat the animal with respect (Kreeger et al. 1990, Iossa et al. 2007, Sneddon et al. 2014).

3.9.4 What Factors Influence Selectivity and Humaneness of Trapping?

Several researchers and organizations have attempted to develop objective, comparable, and statistically relevant methods for evaluating selectivity and humaneness in captured animals (Olsen et al. 1986, Onderka et al. 1990, Philllips 1996, Engeman et al. 1997, International Organization for Standardization 1999). The Association of Fish and Wildlife Agencies (AFWA), as the representative for state wildlife agencies, has a test program for evaluating trap humaneness and effectiveness using five performance criteria: animal welfare, efficiency, selectivity, practicality, and safety to the user. AFWA's overarching goal regarding recreational trapping is to maintain the regulated use of trapping as a safe, efficient, and acceptable means of managing and harvesting wildlife for the benefits it provides to the public, while improving the welfare of trapped animals (Association of Fish and Wildlife Agencies 2006a).

This effort has resulted in species-specific best management practices (BMPs) for selecting traps and trapping practices considered to be effective and humane. AFWA's Furbearer Conservation Technical Working Group has developed these BMPs and provides updates when new information, traps, and practices are developed, most recently in 2019 (https://www.fishwildlife.org//afwa-inspires/furbearer-management). The resulting information is provided to state and federal wildlife agencies, trapper associations, and state agency trapper education programs through workshops, internet, and interactive CDs. These testing and outreach efforts have included funding from the USDA, the International Fur Trade Federation, and state wildlife management agencies. AFWA has tested and approved a variety of commercially-available trap types and trapping practices that meet or exceed BMP standards and guidelines, and the AFWA recognizes that it is likely that additional traps may exist that have not yet been tested (Association of Fish and Wildlife Agencies 2006a).

The BMPs are based on the most extensive study of animal traps ever conducted in the United States, and scientific research and professional experience regarding currently available traps and trapping technologies. Trapping BMPs identify both techniques and trap types that address the welfare of trapped animals and allow for the efficient, selective, safe, and practical capture of furbearers. Trapping BMPs are intended to be a practical tool for recreational trappers, wildlife biologists, and wildlife agencies interested in improved traps and trapping practices. BMPs include technical recommendations from expert trappers and biologists, as well as a list of specifications of traps and/or trap types that meet or exceed BMP criteria. BMPs provide options, allowing for discretion and decision making in the field when trapping furbearers in various regions of the United States. They do not present a single choice that can or must be applied in all cases.

BMPs are available for the following predator species in this EA: badger (Association of Fish and Wildlife Agencies 2014a), bobcat (Association of Fish and Wildlife Agencies 2014b), coyote (specific to Western United States; Association of Fish and Wildlife Agencies 2016a), raccoon (Association of Fish and Wildlife Agencies 2014c), red fox (Association of Fish and Wildlife Agencies 2016b), striped skunk (Association of Fish and Wildlife Agencies 2006b), and wolf (Association of Fish and Wildlife Agencies 2006c).

Humaneness of trapped animals is improved by using traps types and design, and trapping practices that minimize animal injury and suffering, and increasing trap selectivity. The use of BMPs incorporates practices that include equipment specifications, the knowledge of the person using the equipment, and how the equipment is set up (with accessories) and used. Although specific traps are tested, the characteristics of the traps are identified and described as features that, either by themselves or when incorporated with other practices and the experience of the applicator, improve animal welfare and increase trappers' efficiency and selectivity.

3.9.5 What is APHIS-WS Approach to Humaneness, Ethics, and Animal Welfare?

The APHIS-WS Code of Ethics (WS Directive 1.301) states that all employees, volunteers, interns, and personnel conducting official APHIS-WS duties shall adhere to the Code of Ethics, including:

- Promoting competence in the field of wildlife damage management through continual learning and professional development;
- Showing exceptionally high levels of respect for people, property, and wildlife;
- Respecting varying viewpoints regarding wildlife and wildlife damage management;
- Using the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) to resolve wildlife damage problems and strive to use the most selective and humane methods available, with preference given to non-lethal methods when practical and effective.

APHIS-WS believes that all professional personnel must have the skills, experience, and expertise to select the most effective, humane, and practical strategies suitable to the needs and circumstances. Continual learning and training are critical for ensuring that the most effective tools are used, and research and testing must be implemented continuously to improve the tools available and develop new tools. APHIS-WS also considers a tool's effectiveness in meeting the need as well as the effectiveness of an employee's time and cost in implementing those tools. Factors such as weather, device selectivity and effectiveness, personnel considerations, public safety, and other factors must be considered. Selecting effective tools and methods while considering the potential to reduce the risk of suffering helps to increase the overall effectiveness and ethical approach of IPDM.

Wildlife Services employees are concerned about animal welfare. APHIS-WS is aware that some members of the public believe that some IPDM techniques are controversial. Wildlife professional organizations (e.g., The Association of Fish and Wildlife Agencies and The Wildlife Society) recognize that traps and snares are effective and humane for recreational and management use (Association of Fish and Wildlife Agencies 2006a, The Wildlife Society). Training, proper equipment, policy directives, and the use of best practices in the field help ensure that these activities are conducted humanely and responsibly.

In addition, APHIS-WS and the National Wildlife Research Center (NWRC) strive to bring additional non-lethal damage management alternatives into practical use and to improve the selectivity and humaneness of management and capture devices. APHIS-WS has improved the selectivity of management devices through research and development of pan-tension devices, break-away snares, and chemical immobilization/euthanasia procedures that minimize pain.

When implementing IPDM management activities, APHIS-WS evaluates all potential tools for their humaneness, effectiveness, and ability to target specific individuals as well as species, and potential impacts on human safety. APHIS-WS supports using humane, selective, and effective damage management techniques, and continues to incorporate advances into wildlife management activities. APHIS-WS field specialists conducting wildlife damage management are highly experienced professionals, skilled in the use of management methods and committed to minimizing pain and suffering. APHIS-WS has numerous policies and directives that provide direction to staff involved in wildlife control, reinforcing safety, effectiveness, and humaneness (Section 2.4).

WS Directive 2.450 (Section 2.4.1) establishes guidelines for APHIS-WS personnel using certain types of capture devices and promotes training of its employees to improve efficiency, effectiveness, and humaneness. Additionally, all use by APHIS-WS complies with applicable federal, state, and local laws and regulations. Montana state laws also regulate the use of traps, snares, and capture devices (Section 2.4.4). Testing of traps and trapping systems by AFWA has continued to provide valuable information on the humaneness of traps and practices. As the information comes available, it is reviewed by APHIS-WS for its use and application in the field. Recent updates to the BMPs and forthcoming research publications indicate that there will be an increasing number of commercially available traps that meet and or exceed BMP guidelines. WS-Montana continues to use and implement BMP tools and practices as they become available and when appropriate for IPDM. Recognizing the goals of AFWA, APHIS-WS has voluntarily agreed to assist in the development of BMPs and to abide by the BMPs developed by this program, as applicable, using the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) in the field.

3.9.5.1 What are the Considerations for Humaneness for Different Physical Capture Methods?

Different capture methods are discussed below. Impacts to human and pet health and safety and the environment are evaluated in Section 3.10. A humane live-capture (restraint) trap is one that holds an animal with minimal distress or trauma. A humane killing trap is one that renders an animal irreversibly unconscious as quickly as possible.

Seasonality and timing of the use of physical capture devices is an important consideration for humaneness. The removal of predators during the spring months has the potential to result in litters of coyotes or other predators becoming orphaned. When WS-Montana conducts lethal IPDM activities during the April-June period, the potential exists for the take of one or both adult coyotes in a breeding pair that may have a den of pups in the vicinity. In such cases, WS-Montana field personnel make a concerted effort to locate the den in order to dispatch the pups, typically through the use of EPA-registered den fumigant gas cartridges. If the den cannot be located, pups may sometimes be fed and cared for by one or more members of a social group of coyotes associated with that den (Bekoff and Wells 1980). The only way to totally avoid this circumstance would be to refrain from conducting any predator removal efforts during this period of time. Unfortunately, this is also the period during which some of the most serious predation problems occur, such as coyotes killing young lambs to feed their pups (Till and Knowlton 1983).

3.9.5.1.1 Foothold Traps

Traps used in the United States and elsewhere have undergone extensive standards testing and selection as part of an international effort to optimize trap humaneness, selectivity, and effectiveness (Batcheller et al. 2000, Association of Fish and Wildlife Agencies 2006a, White et al. 2015), and was partially funded by APHIS-WS (Association of Fish and Wildlife Agencies 2006a). Humane traps should be practical and equally effective at capturing target animals and avoiding capturing non-target animals (Andelt et al. 1999). BMPs for the predator species in this EA identify key designs or modifications to foothold traps to reduce injury. Approved BMP-compliant foothold trap designs include regular jaw, padded jaw, offset jaw, double jaw, laminated jaw, double-laminated jaw, wide jaw, and some variations combining those features. The "jaw" part of a trap is the portion that makes contact with the foot of the animal being restrained. The various jaw types are designed to reduce injury by increasing surface area, reducing sharp edges, providing gaps to allow more circulation and decreased compression, or padding. They are also designed to minimize the movement of the foot, which allows for secure foot retention while decreasing the risk of injury.

Other features of traps to improve humaneness include anchors attached to the center point of the trap with swivels. Additionally, the use of shorter chain lengths with multiple swivels, and shock springs, help to reduce the impact to the animal when they attempt to pull free, while allowing 360-degree movement to reduce the risk of injury.

The skillset and experience of the individual deploying the traps, combined with these trap modifications and features, complement the BMP guidelines by integrating the trap design, trap accessories, and trapper knowledge to improve humaneness. The BMP's for available species can be found online (https://www.fishwildlife.org//afwa-inspires/furbearer-management) and are referenced in section 3.9.5.

3.9.5.1.2 Box and Cage Traps

Animals captured in box and cage traps for smaller predators, and culvert-type traps for bears may have fewer physical and behavioral traumas than those captured in snares and foothold traps. Although injury rates in cage traps are lower than cables and snares, use of cage traps is a not without risk of injury to the captured animal because animals can injure themselves attempting to escape the trap (e.g., swelling, damage to teeth and muscles) (Shivik et al. 2005, Muñoz-Igualada et al. 2008). Generally, these traps are used if the animal is intended to be released, which is uncommon with IPDM actions except in some circumstances for bears released off-site, with MFWP approval, or if the animal is relatively small, such as bobcats, opossums and raccoons, and the animal will be euthanized on-site. Canids or other trap wise animals are often reluctant to enter cage traps (Way et al. 2002, Shivik et al. 2005).

3.9.5.1.3 Foothold and Neck Snares

WS-Montana uses foothold snares most often for bears and occasionally for mountain lion, but rarely for smaller predators. Neck snares are used routinely for coyotes and often for most or all of the other predator species (Table 2.1; Table E.1). Snares are highly portable and can be readily adapted in the field for many situations.

Effectiveness of snares depend greatly on the skill and expertise of the trapper, often causing them to be less effective than foothold traps when used by less experienced trappers (Onderka et al. 1990, Skinner and Todd 1990). WS-Montana's use of snares is highly selective to minimize unintentional captures (Section 3.7; Table 3.19). Turnbull et al. (2011) found recent models of traps and snares to be about equally effective with low levels of apparent injury and trauma. Foothold snares with stops set at the appropriate size for the target species (and to avoid non-target species capture) appear to have an acceptable effect on animal welfare, with little mortality of target species. However, animals typically have swelling of the foot, with possible long-term limping (Onderka et al. 1990). Reiter et al. (1999) (and reinforced in Darrow et al. 2009) found that public acceptance of the use of cable foot-restraints is slightly higher than for jawed foothold traps. The AFWA Western Coyote BMP identifies specifications for foot snare devices using 1/8 inch cable meet BMP compliance (Onderka et al. 1990, Association of Fish and Wildlife Agencies 2016a).

Bears can be effectively captured using modified foot snares. These snares can be readily transported into and set up in the backcountry, which is difficult with large culvert traps which are pulled behind vehicles. Under normal conditions, injuries may include swelling and abrasions. However, if the snare becomes entangled or the bear struggles energetically, severe injuries can occur. Small bears held in traps are vulnerable to predation by larger bears. Mountain lions may also be effectively and humanely captured using foot snares (Powell and Proulx 2003).

When neck snares are set correctly as a restraint (not as a kill trap), using a stop on the cable, serious injuries are relatively uncommon, although the risk of mortality may be higher than with foothold snares. However, long-term survival is difficult to determine (Iossa et al. 2007). Increased size of the cable for both neck-hold and foothold snares can reduce lacerations but may also decrease effectiveness. Swivels give a struggling animal more flexibility and make it more difficult to entangle or twist the snare. Adding a tranquilizer tab (diazepam) to the snare may also decrease injuries, lunging, and vocalizations (Pruss et al. 2002, Iossa et al. 2007), with the limitations discussed above. Fall (2002) and Garvey and Patterson (2014) also found neck snares with a positive lock, such as Collarum™, to be humane, resulting in fewer injuries to target animals, when set by experienced trappers (APHIS-WS does not endorse any brands). This is a newer model, dependent on a cable loop triggered by pulling on a baited bite piece, and is selective especially for coyotes and dogs (Hout and Bergman 2007). Snares are effective in a variety of weather but use in cold weather should be avoided to minimize risk of limb freezing.

Frey et al. (2007) used snares to live-capture red fox for fitting with radio collars and found the foxes were active the evening following capture and that all females captured reared young the following spring. Over the three-year study period, the authors caught 21 foxes with neck snares, with only two fatal injuries.

Both foot and neck restraint snares can capture non-target species, with risk of mortality. Adding a breakaway snare lock, snare stops, and appropriate pan tension can minimize capture of non-target species and reduce the risk of holding a non-target animal (Iossa et al. 2007).

3.9.5.1.4 Shooting and Pursuit with Dogs

WS-Montana uses shooting and pursuit dogs on a routine basis. Firearms are used for all species once the animal is controlled. Shooting, when applied by a skilled and experienced shooter, is highly selective and humane, causing immediate death when aimed to kill (Hout and Bergman 2007, Julien et al. 2010, American Veterinary Medical Association 2020).

Pursuit of mountain lions and bears with trained dogs can be very effective. Once the animal is either treed or cornered, the animal is typically shot but can be tranquilized when requested by MFWP prior to WS-Montana personnel taking action. A possible concern using pursuit dogs is causing the animal to be physically exhausted, as well as possibly being injured before or during handling (Powell and Proulx 2003). WS-Montana is concerned for the well-being of pursuit dogs used for IPDM and wants to avoid injury or exhaustion from a pursuit. WS-Montana minimizes these risks by considering the terrain, time of day, and duration of pursuit dog use to minimize the risk to both the pursuit dogs and the animal being pursued.

Elbroch et al. (2013) found that the number of hounds used in a mountain lion capture attempt did not necessarily predict the likelihood of capturing a mountain lion, although that is dependent on the skills and experience of both the dogs and the handler. Injuries to dogs and mountain lions may also depend on the skills and experience of the dogs and handler. The authors suggest that foot snares are a potentially safer and more humane capture method for mountain lions than pursuit with dogs when mountain lions are targeted in grassy or open areas with limited opportunities to tree or escape, but hounds may be more effective in habitats with refugia (places to tree or escape) in habitats. Dogs work best when a target mountain lion is actively working the site, as they may not return to the depredation or threat site, or may not return for several nights. The authors did not provide details on the breed and training of the pursuit dogs used, nor the level of experience of the dogs, which can differ substantially among pursuit dog handlers. Dogs bred and carefully trained for pursuit of large predators, such as those used by WS-Montana personnel, are important for consistent safety and effectiveness.

Montana state law and regulations allow the use of pursuit dogs for black bear, mountain lions, and bobcats in damage situations (Section 2.4.4.2).

3.9.5.2 What are the Considerations for Humaneness for Different Chemical Methods?

Chemical methods may be used for lethal take, such as gas cartridges, M-44s, DRC-1339, and euthanasia, or for non-lethal take, such as immobilization. Impacts on human health and safety and the environment for chemical methods are evaluated in Section 3.10.3.

3.9.5.2.1 M-44 Sodium Cyanide

WS-Montana uses sodium cyanide (NaCN) capsules to remove individual coyote and red fox that prey upon livestock, poultry, and federally designated threatened or endangered species. The M-44 spring ejector device delivers a single dose sodium cyanide capsule directly into the mouth or face when the animal bites and pulls up on the spring-activated bait device, pushing the dry sodium cyanide powder into the mouth. Sodium cyanide reacts rapidly with moisture in the mouth or mucus membranes of the nose and eyes to form hydrogen cyanide (HCN), a poisonous toxicant. One sodium cyanide capsule contains enough cyanide to be lethal to animals that come in direct contact through the mouth, the skin, or through inhalation. Cyanide is a rapid-acting asphyxiator, causing death within minutes by depressing the central nervous system, resulting in respiratory arrest. Inhalation toxicity quickly causes disabling muscle weakness, vomiting, convulsions, bloody saliva, and loss of consciousness.

M-44s are highly selective for canids (Section 3.10.3.1) and have many restrictions in their use per the label (Section 2.4.1). The animal normally dies quickly in the field, within one to five minutes due to major depression of the central nervous system, cardiac arrest, and respiratory failure (Section 3.10.3.1). The risk of the animal being observed by a person before death is very low because of the restrictions on using this method in locations where public exposure is probable (Section 2.4.1).

3.9.5.2.2 Gas Cartridge for Denning

WS-Montana uses the Large Gas Cartridge (EPA Reg. No. 56228-21) in rangelands, crop, and non-crop areas to remove coyotes, red foxes, and skunks in dens and burrows. The registered gas cartridge product contains the active ingredients sodium nitrate and charcoal, and two inert ingredients (Fuller's earth and/or borax, which control the rate of burn in the burrow; Johnston et al. 2001). The sodium nitrate supports the combustion of the charcoal, which emits carbon monoxide inside the enclosed burrow while burning. Like oxygen, the primary route of entry for carbon monoxide into an animal is through breathing. Carbon monoxide is poisonous to all animals, like mammals, that use hemoglobin to transport oxygen from the lungs to the cells of the body. Carbon monoxide attaches to hemoglobin to form carboxyhemoglobin, which causes a decrease in oxygen to cells throughout the body resulting in asphyxiation. During the combustion/burning process, oxygen in the burrow is depleted through the combustion of the charcoal.

(American Veterinary Medical Association 2020) documents that the use of 6% CO on dogs for euthanasia resulted in 20 to 25 seconds of abnormal cortical function, during which the dogs became agitated, although it is not clear if this is a sign of distress. CO induces the loss of consciousness without pain and with minimal discernible discomfort. Death occurs rapidly at low concentrations. Personnel using CO must be highly trained and educated. With use by trained and experienced personnel, (American Veterinary Medical Association 2020) and APHIS-WS consider CO a humane euthanasia method.

3.9.5.2.3 DRC-1339 for Raven Depredation

WS-Montana uses DRC-1339 (EPA. Reg. No. 56228-29), 3-chloro-4-methylbenzenamine hydrochloride, to reduce raven, crow, and magpie damage for the protection of newborn livestock, the young or eggs of threatened, endangered, or sensitive species, human health and safety, and silage and fodder bags. DRC-1339 is a slow acting avicide that is rapidly metabolized into nontoxic metabolites and excreted after ingestion. This chemical is one of the most extensively studied and evaluated pesticides ever developed. Because of its rapid metabolism, DRC-1339 poses little risk of secondary poisoning to non-target animals, including avian scavengers (Cunningham et al. 1979, Schafer Jr. 1984, Knittle et al. 1990). In treated birds, DRC-1339 causes renal failure that results in weight loss, depression, lethargy, increased thirst and urination, dehydration, articular gout, and eventually culminates in death (Merck Veterinary Manual 2018).

DRC-1339 acts in a humane manner producing a quiet, painless death. Following the consumption of a lethal dose, DRC-1339 kills target bird species within 3 to 80 hours (Dawes 2006). Birds that consume lethal doses may appear asymptomatic (showing no physical signs of distress) for many hours following chemical ingestion. Typically, in the hours before death (~4 hours), birds cease to eat or drink and become listless, inactive, and may appear comatose (Dawes 2006). With use by trained and experienced personnel DRC-1339 is highly selective for predatory ravens, crows, and magpies and will be used in accordance with the label restrictions.

3.9.5.2.4 What Field Immobilizations Methods are Humane?

Immobilization drugs are used infrequently by WS-Montana, primarily when needed to release an unintentionally captured animal that can't be safely restrained or to safely transport animals that can't be euthanized on site. Immobilization drugs can be administered with a hand syringe of a safely restrained animal, jab stick, or dart gun.

Ketamine (Ketamine HCl; Ketaset™) is a rapid acting, non-narcotic, non-barbiturate injectable anesthetic agent that immobilizes the animal and prevents the ability to feel pain (analgesia). The drug produces a state of dissociative unconsciousness, which does not affect the reflexes needed to sustain life, such as breathing, coughing, and swallowing. Ketamine is possibly the most versatile drug for chemical capture and has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Ketamine is often combined with other drugs, such as Xylazine, maximizing the reduction of stress and pain and increasing human and animal safety during handling. Following administration of recommended doses, animals become immobilized in about 5 minutes, with anesthesia lasting from 30 to 45 minutes. Depending on dosage, recovery may be as quick as four to five hours or may take as long as 24 hours. Recovery is generally smooth and uneventful.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with Ketamine HCl to produce a relaxed anesthesia. This combination can reduce heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions. Xylazine can also be used alone to facilitate physical restraint. Because Xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel must minimize sight, sound, and touch to minimize the animal stress. Recommended dosages are administered through intramuscular injection, allowing the animal to become immobilized in about 5 minutes and lasting from 30 to 45 minutes. Yohimbine is a useful drug for reversing the effects of Xylazine.

Capture-All 5™ is a combination of Ketaset™ and Xylazine, and is regulated by the FDA as an investigational new animal drug. The drug is available through licensed veterinarians to individuals sufficiently trained in the use of immobilization agents. Capture-All 5™ is administered by intramuscular injection; it requires no mixing, and has a relatively long shelf life without refrigeration, all of which make it ideal for the sedation of various species.

Telazol™ is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride, and is a powerful anesthetic for larger animals, such as bears, coyotes, and mountain lions (Fowler and Miller 1999). Telazol™ produces dissociative unconsciousness, which does not affect the reflexes needed to sustain life, such as breathing, coughing, and swallowing. Following a deep intramuscular injection of Telazol™, onset of anesthetic effect usually occurs within 5 to 12 minutes. Muscle relaxation is optimum for about the first 20 to 25 minutes after administration, and then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol™ administered, but usually requires several hours. Although the combination of Ketamine HCl and Xylazine are effective, WS-Montana prefers to use Telazol™ for most of the species that are immobilized.

Propiopromazine HCL is the tranquilizer used in Tranquilizer Trap Device (TTD). TTDs were developed by APHIS-WS NWRC as a means of sedating animals captured in foothold traps to reduce the potential for self-inflicted injuries. TTDs are small rubber nipples fastened to the trap jaw filled with Propiopromazine HCL. When captured, predators instinctively bite the trap tab, ingest the immobilizing drug, and are sedated.

Used properly, the sedative Propiopromazine HCL (Investigational New Animal Drug #9528) does not render the animal unconscious. At this time TTDs are not utilized by WS-Montana.

3.9.5.2.5 What Field Methods are Used for Humane Killing (Euthanasia)?

During IPDM activities, most captured animals are humanely killed in place, rather than immobilized and relocated.

The American Veterinary Medical Association (2020) supports the use of barbiturates (such as sodium pentathol and phenobarbitol), carbon dioxide, carbon monoxide, and gunshot directly to the head for humane euthanasia. Potassium chloride and other chemical drugs are used only when the animal is already immobilized.

Using the following unweighted criteria, a panel of fifteen experienced wildlife professionals evaluated eight methods of field euthanasia (Julien et al. 2010):

- Ability to induce loss of consciousness and death without causing pain
- Time required to induce loss of consciousness
- Reliability
- Safety of personnel
- Irreversibility
- Compatibility with requirement and purpose
- Emotional effect on observers or operators
- Compatibility with subsequent examination or use of tissue
- Drug availability
- Human abuse potential
- Compatibility with species, age, sex, and health status of animal
- Ability for equipment to be maintained in proper working order in the field
- Safety for predators or scavengers, should the carcass be consumed

The panel found that carbon dioxide used with the proper equipment is highly humane and effective, especially for use on raccoons, skunks, and birds. Anesthesia is induced within one to two minutes without undue stress on the animal at CO_2 concentrations of 30% to 40%. However, this needs well-maintained equipment that may not be practical to carry in the field. Gunshot to the brain by an experienced field biologist is humane, instantaneous, and may be the quickest and only method available under most field conditions. All methods of euthanasia should be performed discretely and only by properly trained personnel. Barbiturates such as sodium pentathol and phenobarbitol depress the central nervous system and cause rapid death with minimal discomfort through respiratory and cardiac arrest. With intravenous injection, death typically occurs within 25 to 300 seconds, meeting the standard for humaneness.

American Society of Mammalogy - Animal Care and Use Committee (1998) concurs that shooting is the most effective and humane method of euthanasia in the field if conducted by experienced personnel. Carbon dioxide is also effective and humane, but more difficult to perform in the field without specialized, well-maintained equipment. The

Society also recommends discretion when performing any kind of euthanasia when members of the public may be present.

3.9.5.3 Conclusion

From FY 2013 through 2017, the majority of lethal take (75.3%) by WS-Montana was accomplished through aerial shooting and firearm use. Foot and neck snares comprised 11.5% of WS-Montana's total lethal take. Foothold traps, cage traps, culvert traps, and decoy traps accounted for 2.9% of total lethal take by WS-Montana. Other methods included M-44s (6.8%), sodium nitrate gas cartridges (1.8%), and DRC-1339 for control of predatory ravens (1.7%). Chemical euthanasia and immobilizing drugs are rarely used in the field by WS-Montana (Tables 2.1 and E.1).

These methods are highly selective for target animals, with low unintentional takes of predator and non-predator species during WS-Montana IPDM activities (Table 3.19). WS-Montana personnel are highly trained in the proper use of these methods, follow applicable policies, and utilize best practices to undertake these activities as ethically and humanely as possible under field conditions.

3.9.6 What are the Comparative Impacts of the Alternatives on Humaneness?

3.9.6.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

All WS-Montana field personnel are highly trained in the use of lethal and non-lethal take methods, must follow APHIS-WS training, directives, and ethics policies (Section 2.4), and have extensive field experience in their use and best practices. WS-Montana uses the species-specific BMPs for trapping documented by AFWA as applicable and effective based on specific conditions and availability of and funding for new equipment. Field personnel are sometimes requested to provide training in the effective and humane use of capture methods by cooperators who wish to do their own work, when compliant with state law. Traps and snares used by WS-Montana are updated as often as funding allows, and field personnel are trained in their use. APHIS-WS NWRC actively works to develop new methods and trap modifications to improve effectiveness, selectivity, and humaneness. WS-Montana complies the MOU with MFWP regarding the frequency of trap checks.

APHIS-WS recognizes that not all devices recommended in the BMP guidelines for general public use meet the stringent performance requirements for use in APHIS-WS activities (or other professional wildlife management agencies), particularly for efficiency and durability. WS Directive 2.450 establishes guidelines for APHIS-WS personnel using certain types of capture devices, and promotes training of its employees to improve efficiency, effectiveness and humaneness (Section 2.4.1). Additionally, all use by WS-Montana complies with applicable federal, state, and local laws and regulations. WS-Montana continues to use and implement BMP tools and practices as they become available and when appropriate for managing wildlife damage. Therefore, WS-Montana professional practices, experience, selectivity, and effectiveness in the use of capture and kill methods reduce the risk of suffering to the extent possible under field conditions, weather, APHIS-WS policy, and state laws and regulations. Landowners are notified of their responsibility for the safety of their pets and livestock on private land.

From FY 2013 through 2017, the majority of lethal take (75.3%) by WS-Montana was accomplished through aerial shooting and firearm use. Foot and neck snares comprised 11.5% of WS-Montana's total lethal take. Foothold traps, cage traps, culvert traps, and decoy traps accounted for 2.9% of total lethal take by WS-Montana. Other methods included M-44s (6.8%), sodium nitrate gas cartridges (1.8%), and DRC-1339 for control of predatory ravens (1.7%). Chemical euthanasia and immobilizing drugs are rarely used in the field by WS-Montana (Tables 2.1 and E.1).

These methods are highly selective for target animals, with low unintentional takes of predator and non-predator species during WS-Montana IPDM activities (Table 3.19). Therefore, WS-Montana would continue to practice and uphold high standards of humaneness and ethics under Alternative 1.

3.9.6.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. WS-Montana would continue to practice and uphold high standards of humaneness and ethics, as described under Alternative 1.

However, in the absence of lethal assistance from WS-Montana, some people may feel that it is unethical and inhumane not to take lethal measures to protect domestic animals from predation, if necessary. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally or less humanely by other entities, as a result of less selective and less proficient removal efforts. Additionally, while many WCOs are trained in BMPs, other private entities are not required to follow BMP guidelines. Therefore, other private entities may have less ethical or less humane lethal IPDM actions. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 2, there are likely to be less humane and ethical practices by other entities compared to Alternative 1.

3.9.6.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. WS-Montana would continue to practice and uphold high standards of humaneness and ethics, as described under Alternative 1. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because even if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would be likely to continue to conduct IPDM activities as described in Section 3.4.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally or less humanely by other entities, as a result of less selective and less proficient removal efforts. Additionally, while many WCOs are trained in BMPs, other private entities are not required to follow BMP guidelines. Therefore, other private entities may have less ethical or less humane lethal IPDM actions. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 3, there are likely to be less humane and ethical practices by other entities compared to Alternative 1.

3.9.6.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. WS-Montana would continue to practice and uphold high standards of humaneness and ethics, as described under Alternative 1. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, in the absence of lethal assistance from WS-Montana for non-T&E species protection requests, some people may feel that it is unethical and inhumane not to take lethal measures to protect domestic animals from predation, if necessary. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally or less humanely by other entities, as a result of less selective and less proficient removal efforts. Additionally, while many WCOs are trained in BMPs, other private entities are not required to follow BMP guidelines. Therefore, other private entities may have less ethical or less humane lethal IPDM actions. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 4, there are likely to be less humane and ethical practices by other entities compared to Alternative 1.

3.9.6.5 Alternative 5. No WS-Montana IPDM Activities

WS-Montana would continue to practice and uphold high standards of humaneness and ethics, as described under Alternative 1. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Depending on the skillset of others, it is possible that more animals could be taken unintentionally or less humanely by other entities, as a result of less selective and less proficient removal efforts. Additionally, while many WCOs are trained in BMPs, other private entities are not required to follow BMP guidelines. Therefore, other private entities may have less ethical or less humane lethal IPDM actions.

Therefore, under Alternative 5, there are likely to be less humane and ethical practices by other entities compared to Alternatives 1-4.

3.10 What are the Potential Impacts on the Environment and Risks to Human and Domestic Animal Health and Safety of WS-Montana IPDM Methods?

This section evaluates the potential impacts and risks associated with mechanical and chemical IPDM methods used by WS-Montana on environmental resources and human and domestic animal (including pets and livestock) health and safety. This includes effects on the environment as applicable for each method (water, soil, aquatic and terrestrial vertebrates and invertebrates, including wildlife) and members of the public, recreationists, hunters, and WS-Montana employees. Risk assessments have been created for WS methods included in this EA (USDA Wildlife Services 2017f), and these can be reviewed at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments.

The analysis of each mechanical and chemical method is based on a thorough national risk assessment of each APHIS-WS method, with additional information included from WS-Montana activities and the literature where available.[3] All of the methods evaluated in this section are described in detail in Appendix A and summarized in Section 2.3.1.7.

Other issues related to the use of these methods and chemicals are evaluated in the following sections:

- Efficacy of IPDM (Section 1.12);
- Impacts on predator populations (Sections 3.5, 3.6, and 3.7);

[3] Refer to Section 3.4 for information regarding assumptions about lethal actions others might take to address predator damage in the absence of WS-Montana or if WS-Montana lethal activities are restricted.

- Impacts on predator and non-predator populations, including federally-listed threatened and endangered species from unintentional take (Sections 3.5, 3.6 and 3.7);
- Humaneness of methods (Section 3.9).

APHIS-WS directives and policies for the use of IPDM methods are described in Section 2.4.1 through 2.4.3 and the associated state of Montana laws and regulations are included in Section 2.4.4.

3.10.1 What are the Potential Impacts and Risks Associated with Mechanical/Physical Methods?

Mechanical/physical methods include physical capture devices, such as cage traps, cable restraints, foothold traps, and quick-kill/body grip traps.

3.10.1.1 What are the Potential Impacts and Risks Associated with Physical Capture Devices?

WS-Montana uses four primary types of physical capture devices during IPDM activities – cage traps, cable restraints (both foothold and neck snares), foothold traps, and quick-kill/body grip traps and has conducted associated risk assessments. Descriptions of these methods are found in Appendix A. Risks related to the use of mechanical/physical capture devices by APHIS-WS are examined in detail in several *USDA, APHIS, WS Risk Assessments* (USDA Wildlife Services 2017i;2019d;c;h) which can be found at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments.

3.10.1.1.1 What are the Potential Impacts of Physical Capture Devices on Soil, Water, and Terrestrial and Aquatic Species?

Cage traps, metal foothold traps, quick-kill traps, and snares are physical devices that have little to no potential to affect soil, water, terrestrial plants, freshwater and terrestrial invertebrates, amphibians, reptiles, and fish. Food baits, such as tuna fish, eggs, meat, or peanut butter, are sometimes used to encourage target animals to investigate and enter or activate traps; however, the amount of natural bait is small, and quickly decomposes or is eaten by small animals or insects. When the trap is pulled, the WS-Montana employee removes and discards any remaining bait. Although plant matter may be used to hide or camouflage the trap, this is usually dead material already existing in the trap area, such as sticks or plant debris.

Therefore, there is little to no potential effect on soil, water, or terrestrial plants by the use of physical capture devices when used either by WS-Montana employees and/or any other person.

3.10.1.1.2 What are the Potential Risks from Physical Capture Devices on Public Health and Safety, Including Recreationalists and Hunters, and Domestic Animals?

Per WS Directive 2.450, capture devices should be set to minimize the visibility of captured animals to the public (Section 2.4.1). Nearly 93% of WS-Montana's predator take occurs on private land (Table 2.2) and WS Directive 2.450 requires APHIS-WS employees to make reasonable efforts to obtain approval from adjacent landowners when setting traps or snares under fence lines to avoid capture of domestic animals (Section 2.4.1). Most IPDM activities are conducted away from areas of high human activity except when directly applied on private landowner property to address a specific damage problem. If there is a risk of people being present, then, whenever possible, activities are conducted during periods when human activity is low, such as at night or early morning (Section 2.4.3.1).

Bilingual warning signs are used near trap sets placed on public lands to alert the public about hazards to people and domestic animals from traps or captured animals. Live traps, culvert traps, and snares set for black bears are placed so that captured animals are not readily visible from any designated recreation road or trail or from federal, state, or county roads and, if used in areas with bears damaging campgrounds, development dumpsters or other areas where the public frequents, signs are placed on each end of the culvert trap to warn people away (Section 2.4.3.1).

Use of traps and snares is restricted in public safety zones designated in USFS or BLM Annual Work Plans for IPDM on federal lands. A public safety zone is one-quarter mile, or other appropriate distance, around any residence or community, county, state or federal highway, or developed recreation site. IPDM conducted on federal lands within identified public safety zones are generally limited to activity conducted for the protection of human health and safety. However, a land management agency or cooperator could request IPDM activities in the public safety zone for another type of identified need and would be coordinated with the land management agency. Depending on the situation and applicable laws and regulations, federal permittees could request either WS-Montana or others to conduct IPDM activities. However, when WS-Montana conducts the activities, it notifies the land management agencies of IPDM activities that involve methods of possible concern, such as firearms, dogs, and traps, before these methods are used in a public safety zone, unless specified otherwise in the Annual Work Plan and as appropriate (Section 2.4.3.1). This is not necessarily the case for IPDM work conducted by other entities or individuals.

Only one pet/livestock animal (not differentiated in the MIS database) was unintentionally captured in FY 2013 through FY 2017 while conducting IPDM when it was caught in a foothold trap by WS-Montana (Table 3.19). The animal was subsequently released without harm. During that same period, six feral/free-ranging dogs were caught in foothold traps and neck snares and were released unharmed (Table 3.19). Additionally, during this time period three feral/free-ranging dogs were taken unintentionally with M-44s (Table 3.19). Unintentional capture and/or take does occur, however, it is a rare and infrequent event.

Therefore, the potential for the public, recreationists, hunters, landowners, and domestic animals to encounter and be captured or killed by a trap or snare set by WS-Montana and/or any other person/entity is very low on private lands and highly unlikely on public lands.

3.10.1.1.3 What are the Potential Risks of Using Physical Capture Devices to WS-Montana Employees?

WS-Montana employees operating in the field work with physical capture devices routinely, and have a high potential to encounter and handle wildlife, both live and dead, as part of their daily work. The health and safety hazards associated with the use of physical capture devices potentially include cuts, abrasions, bruises, or bone fractures for the hands or fingers from the accidental discharge of a trap or the trigger of some snares. Most injuries occur while setting or placing metal foothold traps. Setting traps also involves bending, kneeling, and pounding and pulling stakes, which could potentially lead to back strains. When using snares, an employee may be cut on broken strands of cable. These risks are assessed in detail in USDA Wildlife Services (2018b) which can be viewed at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments.

Skilled WS-Montana professionals routinely follow APHIS-WS directives and standard safety practices, especially the use of PPE and safety requirements, which substantially reduces the risk of major or even minor injury during trapping and snaring activities, based on historical records. Therefore, the risk to WS-Montana field employees is considered very low. The risk to non-WS-Montana entities depends on their proficiency and experience with the equipment and its placement.

3.10.1.2 What are the Potential Impacts and Risks from the Use of Firearms and Firearm-like Devices?

Firearms, including rifles, pistols, air rifles, and shotguns, are used on a frequent or even daily basis by APHIS-WS and WS-Montana field employees to lethally take or euthanize wildlife during IWDM activities.[4] Firearms are one of the most frequently used methods by APHIS-WS field employees, and are used in all types of settings, including urban and rural areas, if they can be used safely. Because firearms are inherently dangerous and use may occur under difficult conditions or high-profile public circumstances, all use must be safe, accurate, and with high competency. Therefore, APHIS-WS requires extensive training and certification for employees to use firearms (WS Directive 2.615; Section 2.4.1). Risks associated with the use of firearms in wildlife damage management by APHIS-WS have been carefully assessed in USDA Wildlife Services (2019g) which is available for review at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments.

APHIS-WS field personnel select firearms appropriate to an intended use, and which include rifles, shotguns, air rifles, or pistols. For example, WS-Montana personnel may use a larger caliber firearm to take bears or a smaller caliber firearm for raccoons. Field employees base the selection of weapon type and size on several factors, including the target animal, likely distance to target, humaneness, accuracy, safety, and noise in

[4] The humaneness of using firearms for removing or euthanizing animals is discussed in Section 3.9.6. The use of firearms during aerial activities is discussed in Section 3.10.1.3. APHIS-WS policy for use of firearms is found in WS Directive 2.615 (Section 2.4.1).

sensitive areas. Direction of ricochet/pass-through is difficult to predict and is a safety concern, especially at airports, in areas near residences, areas with rocky substrate, and for APHIS-WS personnel in aerial shooting teams.

In addition to euthanization, WS-Montana uses firearms, on the ground and from the air, to intentionally lethally remove about 75% of predators, with over 98% of the take with firearms being coyotes. Firearms are also used to intentionally take black bears, striped skunks, mountain lions, red foxes, badgers, gray wolves, common ravens, and feral and free-ranging cats (Tables 2.1 and E.1). Firearms are highly selective; WS-Montana employees rarely take predators and non-predator animals unintentionally with this method (Table 3.19).

No WS-Montana employee has unintentionally lethally removed a federally-listed threatened or endangered species with a firearm. All firearms are safely carried and stored per WS Directive 2.615 (Section 2.4.1).

3.10.1.2.1 What are the Potential Impacts to the Environment from the Use of Firearms?

Firearms are highly selective when used by experienced and trained personnel. APHIS-WS personnel are highly trained in safety, target selection, and humaneness training and experience. There is no impact on the environment when a firearm is used as a euthanizing agent at very close range, and an impact on the environment is highly improbable when a firearm is used at the appropriate distance from the ground or from an aircraft.

Night shooting may be conducted in sensitive areas that have high public use or other activity during the day or to detect and shoot target animals that are active at night, such as coyotes. Specialized equipment, such as lights, night vision, and thermal imagery, increases the selectivity and accuracy of firearm use at night.

Most shotgun shell casings (hulls) are plastic with a brass end (a mixture of mostly copper with some zinc alloys); bullet casings are composed primarily of brass. Bullet casings from centerfires and shotgun hulls may be left on the ground, but are typically retrieved by field personnel, with the exception of shotgun hulls from aerial shooting. Brass is generally resistant to environmental corrosion, and oxidizes over a very long period of time. The primers are also generally made up of brass. Materials making up the explosives in the primer are burned upon contact. Plastic shell hulls are mostly made of high-density polyethylene plastic and, sometimes, a low-density polyethylene plastic. If not retrieved, the plastic will degrade into small pieces in sunlight over a long period of time. Paper wads in the projectile follows the shot for a distance, then fall to the ground to degrade quickly.

Firing at target animals with harassment projectiles is always conducted at a sufficient distance to cause the animals to flee and is not intended to harm the target animal. Paintballs used in hazing are non-toxic to the environment, biodegradable and soluble in water. Most of the ingredients are food grade.

With the high level of proficiency and safety training provided to APHIS-WS and WS-Montana field employees and when firearms are used according to APHIS-WS directives and training, the use of firearms and firearm-like devices is highly selective and have a negligible impact on the environment.

3.10.1.2.2 What is the Accident Risk of WS-Montana's Use of Firearms to the Public, Including Recreationists, Hunters, and Domestic Animals?

APHIS-WS and WS-Montana employees are highly trained and proficient in the use of firearms. They are trained to know the distance that different ammunition types fired from various firearms may travel before losing energy and are cognizant of the potential for recreationists and hunters to be in the area. APHIS-WS has never had an accidental shooting of any member of the public (USDA Wildlife Services 2017c).

Dogs have been known to eat paintballs, which may cause toxicosis. However, with veterinary treatment, they typically recover within 24 hours (Donaldson 2003). WS-Montana is not aware of any dog having eaten a paintball it has used in IPDM. WS-Montana anticipates rarely using paintball firearms for hazing predators.

Based on the level of training and proficiency in the use of firearms under a variety of circumstances and conditions, and the lack of past accidents, the likelihood for an incident involving any member of the public or domestic animals is negligible.

3.10.1.2.3 What are the Potential Risks to WS-Montana Field Employees from Using Firearms?

The risk to WS-Montana field employee's health with the use of firearms and firearm-like devices ranges from minor incidents to potentially significant accidents that may result in injury or property damage. The most common potential risks involve bruises to the shoulder and face from firearm recoil, damage to hearing from sustained use without proper hearing protection, eye damage from ammunition debris upon firing, and accidental gunshot wound from improper handling. Mechanical malfunction of the firearm or defective ammunition could result in shrapnel, lacerations, punctures, or damage to eyes or limbs.

To protect hearing, in addition to using PPE when appropriate, APHIS-WS initiated a Hearing Conservation Program to minimize hearing loss and monitor employees subjected to frequent noise based on the applicable Occupational Safety and Health Administration Hearing Conservation guidelines (Occupational Safety and Health Administration 2002). This program provides hearing tests for employees exposed to eight hours of 85 dB or higher noise. Employees are required to wear adequate hearing protectors and be trained how to use them before working at harmful noise exposure thresholds. Periodic hearing tests for such employees are required to determine if hearing is being impaired.

Additionally, precautions taken by APHIS-WS employees include knowing what is beyond targets, wearing eye protection, and storing firearms and ammunition so they are not accessible to unauthorized persons.

WS-Montana employees are highly familiar with the firearms they use, which ensures accuracy and safety. The APHIS-WS risk assessment on the use of firearms in WDM (USDA Wildlife Services 2019g) found that employees have had 55 accidents related to the use of firearms between 2011 and 2015, averaging 10.2 per year, typically due to firearm and ammunition malfunctions. Incidents resulting from operator error were minimal.

No accidents or incidents involving firearms have been recorded by WS-Montana in at least ten years. Although not identified specifically due to firearms, WS-Montana field employee accidents and resultant injuries overall are minimal.

Lastly, because APHIS-WS field personnel operate firearms outdoors, they are not directly exposed to the low volume of particulates created by firing a firearm.

With proper and repeated training per WS Directives 2.615 and 2.625 (Section 2.4.1), constant awareness, and proper use of PPE, accidents other than those caused by firearm and/or ammunition malfunctions can be and are mostly avoided, as indicated by data in the detailed risk assessment of the use of firearms in USDA Wildlife Services (2019g).

3.10.1.3 What are the Potential Impacts and Risks from the Use of Aircraft and Aerial Shooting?

WS-Montana uses or contracts for fixed-wing aircraft and rotary-wing aircraft (helicopters) for intentional aerial shooting of predators (61% of total IPDM lethal take) on areas under agreement. APHIS-WS has conducted detailed risk assessments of the use of firearms and aircraft in USDA Wildlife Services (2019a;2019g) for wildlife damage management which are available for review at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments.

In Montana, these activities occur primarily in late winter and early spring, during lambing and calving seasons. The most commonly used fixed-wing aircraft are Piper PA-18 Super Cubs and CubCrafters CC-18 Top Cubs. The most frequently used rotary-wing aircraft are Hughes MD500s and Bell OH-58s. WS-Montana currently uses shotguns for aerial shooting, but some rifles may be used selectively in the future if approved by APHIS-WS.

APHIS-WS has used aerial shooting for over sixty years, with no known adverse impacts on any native wildlife populations, and adverse impacts are not anticipated in the future. APHIS-WS avoids other wildlife when observed during flying time. It is expected that WS-Montana aerial shooting and flights will not cause any long-term adverse impacts to non-target species, including those that are listed as threatened and endangered. In addition, no unintentional take by WS-Montana has occurred between 2013 and 2017 during aerial shooting activities, and no humans on the ground have been injured as a result of a crash or during aerial shooting (USDA Wildlife Services 2017b).

3.10.1.3.1 What are the Potential Impacts on Wildlife from Low-level Overflights?

Low-level flight impacts to wildlife have been studied extensively, and this research has informed the APHIS-WS position on the potential effects of our aerial operations. Studies evaluated as part of this analysis included:

- **Kushlan (1979):** low-level overflights of 2-3 minutes by a fixed-wing airplane and a helicopter produced no drastic disturbance of tree-nesting colonial waterbirds
- **Conomy et al. (1998):** only 2% of wintering American black ducks, American wigeon, gadwall, and American green-winged teal (*Anas crecca carolinensis*) exposed to low-flying military aircraft reacted

- **Delaney et al. (1999):** Mexican spotted owls (*Strix occidentalis lucida*) did not flush when chain saws and helicopters were greater than 110 yards away; owls flushed to these disturbances at closer distances but were more prone to flush from chain saws.
- **Johnson & Reynolds (2002):** Mexican spotted owls showed minor behavioral changes to F-16 training runs, but less than to natural and other man-made occurrences
- **Andersen et al. (1989):** red-tailed hawks habituate to low-level helicopter flights during the nesting period
- **White and Thurow (1985):** ferruginous hawks are sensitive to certain types of ground-based human disturbance. However, neither low-flying military jets nor fixed-wing aircraft within 100 feet impacted them
- **Ellis (1981):** five species of hawks, two falcons, and golden eagles were tolerant of overflights by military fighter jets; negative responses were brief and never limited productivity
- **Grubb et al. (2010):** golden eagles were not adversely affected by civilian and military helicopter flights in northern Utah
- **Krausman et al. (1986):** three of 70 observed mule deer responses to fixed-wing aircraft overflights at 150 to 500 feet above ground resulted in changing habitats, but they may have become accustomed to frequent aircraft activity in the area
- **VerCauteren and Hyngstrom (2002):** overflown deer typically stood up from beds, but did not flush
- **Krausman and Hervert (1983):** in 32 observations of responses of bighorn sheep to low-level flights by small fixed-wing aircraft 60% resulted in no disturbance, 21% in "slight" disturbance, and 19% in "great" disturbance
- **Krausman et al. (1998):** 14% of bighorn sheep had elevated heart rates that lasted up to 2 minutes after an F-16 overflight at 400 feet, but it did not alter the behavior of penned bighorns.
- **Weisenberger et al. (1996):** desert bighorn sheep (*Ovis canadensis nelsoni*) and mule deer had elevated heart rates for 1 to 3 minutes and became alert for up to 6 minutes following exposure to jet aircraft.
- **Fancy (1982):** two of 59 bison groups reacted to fixed-wing aircraft flying at 200-500 feet above ground

APHIS-WS uses fixed- and rotary-wing aircraft for aerial PDM activities only in areas under agreement and concentrates efforts during certain times of the year such as during lambing. APHIS-WS annually flies less than 20 min/mi^2 (this is equivalent to under two seconds per acre), on properties under agreement (MIS 2020). WS avoids disturbing non-target wildlife whenever possible. APHIS-WS has concluded that disturbance effects on raptors, ungulates, and other species are short-lived and negligible and will not cause adverse impacts to non-target species including those that are threatened or endangered (USDA Wildlife Services 2017b).

3.10.1.3.2 What Are the Potential Impacts of Aircraft Sound on the Public, Including Recreationists and Hunters?

The response of humans to noise depends on the frequency, intensity, duration, and fluctuations in sound pressure, personal perception, and atmospheric conditions (cold dense air transmits sound more readily than warm breezy air). The distance from the source of the noise and attenuation of the sound from buildings, vegetation, wind, humidity, and temperature also affects the level of perceived noise (USDA Wildlife Services 2017b).

Hunters wearing Hunter Orange for safety would likely be visible to aerial crews and could thereby be avoided to reduce all forms of risk including from noise. In addition, WS-Montana limits or avoids aerial shooting during hunting seasons, and it conducts most aerial shooting on private lands and in remote areas. These measures prevent or limit overlap between aerial shooting and recreational uses. Furthermore, WS-Montana aerial shooting occurs mostly over private land where landowners would notify WS of ongoing recreational uses. When on public lands, WS-Montana is notified by public land managers, during Annual Planning meetings and at other times, of areas with high potential for recreational use.

Federal Aviation Administration rules require pilots to stay at least 500 feet from people or human structures, and WS-Montana adheres to these rules. It is feasible that a person may not be seen, but air and ground crews continuously watch for people to avoid them. Most areas where WS-Montana conducts aerial shooting are sparsely vegetated and people are likely to be seen. In rare instances, people in the vicinity of aerial IPDM activities are startled, but have not been within minimum safe distances.

3.10.1.3.3 What are the Potential Risks to the Health and Safety of WS-Montana Employees during Aerial Activities?

Aerial shooting combines the use of aircraft and firearms. Risks related to aviation accidents include harm to crewmembers and loss of aircraft. APHIS-WS use of aircraft is quite different from general aviation (GAV) use. The environment where APHIS-WS conducts aerial hunting is inherently a higher risk environment than that for GAV. Low-level flights introduce hazards such as power lines and trees, and the safety margin for error during maneuvers is diminished compared to high-level flights. Seventeen aviation accidents involving APHIS-WS and contract pilots occurred from 2000 to 2016 (17 years) in 234,528 hours of fixed-wing and rotary-wing flying nationwide. This equates to 7.2 accidents per 100,000 hours of flying, just minimally over the national general aviation accident rate of 6.7 per 100,000 hours of flying.

Since 2000 WS-Montana has reported two accidents while conducting aerial operations, one fixed-wing wing and one rotary-wing, resulting in four injuries and no fatalities. In that same time period, WS-Montana aircraft flew approximately 36,656 hours, resulting in a rate of 5.5 accidents per 100,000 hours of flying. WS-Montana has not experienced any accidents or incidents directly related to aerial shooting since 2003. WS-Montana has determined that the risk of accidents related to aerial activities is minimal and comparable to, or lower than, that of general aviation.

3.10.1.3.4 What is the Potential for Hazardous Spills from an APHIS-WS Aircraft Crash?

The risk of fire or hazardous spills related to WS Montana's aerial shooting activities are considered negligible. In addition, the National Transportation Safety Board considers risks of fire and from hazardous spills related to government aircraft operations and accidents to be negligible nationwide, and no such incidents have been attributed to WS-Montana aerial operations.

3.10.1.3.5 What is the Potential for Compromised Physical Security of APHIS-WS Aircraft and Related Facilities?

WS-Montana personnel are trained to reduce the threat of theft or illicit activities associated with APHIS-WS or contracted aircraft. No aircraft either owned or contracted by APHIS-WS or WS-Montana has ever been stolen and the potential for such occurrences is considered negligible under all alternatives considered here (USDA Wildlife Services 2017b).

3.10.1.4 What are the Potential Impacts and Risks from the Use of Trained Animals?

A trained dog, as defined by WS Directive 2.445 (Section 2.4.1) is a dog that is proficient in the skills necessary to perform specific functions in a manner responsive to its handler's commands by exhibiting the desired or intended behavior. Such dogs shall not pose a threat to humans or domestic animals or cause damage to property.

Trained dogs are used to track or trail animals, detect particular species or their sign, retrieve animals taken with another method such as firearms, haze animals from an area where they are not wanted such as birds in an air operating area, and decoy or attract coyotes which respond to canid invasions of their territories. Additionally, dogs, along with other animals, are sometimes used to guard and protect livestock from other predators.

Dogs may be owned by APHIS-WS personnel or by contractors hired by the agency for use. The tracked or decoyed animal may be either euthanized or immobilized, depending on state law and management objectives. WS Directive 2.445 requires personnel to ensure that trained dogs have all the necessary care, including appropriate housing, food, and all required licenses and vaccinations per applicable state and local laws (USDA Wildlife Services 2017g).

3.10.1.4.1 What are the Potential Impacts of the Use of Trained Animals to the Environment?

Dogs in training or improperly trained dogs could pursue and harass non-target wildlife from the area.

Pursuant to the Migratory Bird Treaty Act, a dog handler cannot allow their dog to catch or harm protected migratory birds unless they are targeted and being harassed or retrieved by working dogs under the appropriate permit. In some cases, a state permit may also be required to haze wildlife using dogs. Handlers must especially consider the flightless period for birds or birds commonly on the ground feeding, nesting, or molting to ensure that dogs do not harass or kill them as easy targets.

To avoid stress and injury of the target animals from the resultant struggle to avoid a dog when restrained, the handler must exhibit a high level of respect and professionalism and control the dog from harassing or attacking the animal.

Complying with the requirements of WS Directive 2.445 (Section 2.4.1) results in a negligible risk of injury to non-target animals or to restrained animals.

3.10.1.4.2 What are the Potential Risks to the Health and Safety of WS-Montana Employees and the Public from the Use of Trained Animals?

To ensure proper control of the dogs, APHIS-WS personnel use various methods and equipment, such as muzzles, electronic training collars, harnesses, and leashes. In addition, APHIS-WS personnel are required to obtain appropriate licenses and vaccinations for their trained dogs in accordance with applicable state and local laws. When in appropriate settings such as an urban area, APHIS-WS dog handlers follow applicable leash laws when using trained dogs. These policies tend to minimize problems with dogs and potential to impact human health and safety.

No members of the public have been injured by trained dogs handled by APHIS-WS employees or by animals that were at bay or controlled by trained dogs for at least the last ten years. No WS-Montana employees have been bitten by trained dogs in over ten years (USDA Wildlife Services 2017g).

Highly trained livestock guarding animals, such as dogs or llamas, are under the ownership, care, and control of the livestock owner or their agent. Activities of WS-Montana field personnel in investigating depredation events or conducting IPDM activities may be in the vicinity of such animals and must take care not to distract or directly interact with them. They are trained to protect the livestock from all threats, including perceived threats from people, and are not socialized to human interactions.

The risk of injury to field employees or the public from trained dogs actively working in the field and under the control of handlers, as well as livestock guarding animals, is negligible.

3.10.1.4.3 What are the Overall Environmental Impacts and Health and Safety Risks Associated with the Use of Trained Animals?

The limited number of WS-Montana field personnel experienced in the use of trained dogs, or currently using them, are required to protect both themselves and their dogs. WS-Montana personnel are also experienced with the training and behavior of valuable livestock guarding animals, and they are careful to protect themselves and the animals. The impacts and risks are negligible for both employees and animals under all alternatives involving WS-Montana field activities associated with livestock or the use of pursuit dogs for trailing or capturing predators.

For alternatives involving non-WS-Montana field personnel, risks and impacts associated with the use of trained dogs would likely be similar, because owners of such trained and valuable dogs are presumably experienced. However, non-WS-Montana entities hired by landowners may not be experienced with conducting activities near livestock guarding animals and may be injured or inadvertently injure the animal. This could occur for any alternative in which WS-Montana activities are restricted.

3.10.1.5 What are the Comparative Impacts of the Alternatives from the Use of Physical/Mechanical Methods?

3.10.1.5.1 Alternative 1. Proposed Action/ No Action Alternative: Continue WS-Montana IPDM Assistance

The analysis for impacts on soil, water, and terrestrial and aquatic species indicates little to no effect on the environment from WS-Montana's use of any physical capture devices, shooting, aerial shooting, or trained animals. The effects of lead ammunition will be discussed in Section 3.10.2.

Risks to human health and safety, including recreationists, hunters, and domestic animals from WS-Montana's use of mechanical/physical methods is very low on private lands. Additionally, impacts or risks to humans and domestic animals are highly unlikely on public lands due to the very low potential to encounter equipment set, the relatively short duration of IPDM activities occurring in a particular area and protective measures as described in Section 2.4. WS-Montana employees have a high level of proficiency and are routinely trained in the use of mechanical/physical methods.

WS-Montana employees always follow APHIS-WS directives and other protective measures, including the use of PPE and safety requirements, which substantially reduces the risk of major or minor injuries during IPDM activities, based on historical records (USDA Wildlife Services 2019g). Between FY 2013 and FY 2017, there were 6 field-related injuries reported by WS-Montana employees through the workman's compensation process, mostly related to conducting operations in the outdoors, but not necessarily related to the use of equipment.

WS-Montana has determined that the risk to humans and domestic animals from WS-Montana's use of mechanical/physical methods is very low on private lands and highly unlikely on public lands.

3.10.1.5.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4. With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4).

Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent experience with lethal methods and/or the knowledge to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees.

WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2). Both private individuals and WCOs may not have the specific initial and reoccurring training for firearm, aerial shooting, and other methods that WS-Montana implements for its employees. The consistent use of PPE by private entities is likely to be lower than that used by WS-Montana employees. The level of accidents and risk of injury may be higher for private individuals and landowners who are not proficient or experienced with the use of many of the physical/mechanical methods. When aerial shooting, private individuals may spend more time flying over an area or implementing IPDM methods as described in Section 3.4.

Because it is likely that most lethal methods used by private entities would be conducted mostly on private land, there is low likelihood that recreationists and hunters would encounter equipment placed by landowners or their agents. However, depending on the skillset of other entities in minimizing the risks to the environment, humans, and domestic animals, effects could be greater than, less than, or similar to those under Alternative 1. It is possible that the environment, humans, and domestic animals may have fewer exposures to IPDM methods in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, and because individuals experiencing damage may not take action themselves. Conversely, people and domestic animals could be exposed to an increase in IPDM methods and activities by other entities as a result of increased and less selective IPDM efforts. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

WS-Montana's effects on the environment, humans, and domestic animals from the use of mechanical/physical methods would be less than Alternative 1. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of mechanical/physical methods compared to Alternative 1.

3.10.1.5.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Other entities would likely increase lethal

IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent experience with lethal methods and/or the knowledge to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2). Both private individuals and WCOs may not have the specific initial and reoccurring training for firearm, aerial shooting, and other methods that WS-Montana implements for its employees. The consistent use of PPE by private entities is likely to be lower than that used by WS-Montana employees. The level of accidents and risk of injury may be higher for private individuals and landowners who are not proficient or experienced with the use of many of the physical/mechanical methods. When aerial shooting, private individuals may spend more time flying over an area or implementing IPDM methods as described in Section 3.4.

Because it is likely that most lethal methods used by private entities would be conducted mostly on private land, there is low likelihood that recreationists and hunters would encounter equipment placed by landowners or their agents. However, depending on the skillset of other entities in minimizing the risks to the environment, humans, and domestic animals, effects could be greater than, less than, or similar to those under Alternative 1. It is possible that the environment, humans, and domestic animals may have fewer exposures to IPDM methods in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, and because individuals experiencing damage may not take action themselves. Conversely, people and domestic animals could be exposed to an increase in IPDM methods and activities by other entities as a result of increased and less selective IPDM efforts. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

WS-Montana's effects on the environment, humans, and domestic animals from the use of mechanical/physical methods would be similar to Alternative 1. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of mechanical/physical methods compared to Alternative 1.

3.10.1.5.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, gray wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. However, other commercial, governmental, and private entities and landowners would continue to conduct or increase their IPDM activities as described in Section 3.4.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Additionally, private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. This lack of training and experience will likely increase adverse effects on the environment, humans, and domestic animals.

Because operational lethal actions would be limited and not available to manage damage to other resources, WS-Montana effects on the environment, humans, and domestic animals from the use of mechanical/physical methods would be less than Alternatives 1 and 3. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of mechanical/physical methods compared to Alternative 1.

3.10.1.5.5 Alternative 5. No WS-Montana IPDM Activities

WS-Montana would have no effect on the environment, humans, and domestic animals from the use of mechanical/physical methods. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees.

Therefore, effects on the environment, humans, and domestic animals by the use of mechanical/physical methods by other entities would be expected to be higher than under Alternatives 1-4.

3.10.2 What are the Potential Impacts and Risks from the Use of Lead Ammunition?

Agencies and members of the public have expressed concerns regarding the potential for adverse environmental impacts and risks to human and wildlife health and safety and environmental contamination from the use of lead ammunition by APHIS-WS. APHIS-WS has conducted a thorough risk analysis on lead use in wildlife damage management which is available for review at https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct-ws-risk_assessments (USDA Wildlife Services 2017h).

3.10.2.1 Background

As discussed in Sections 3.10.1.2 and 3.10.1.3, ground and aerial shooting are critical components of APHIS-WS activities. APHIS-WS has specific ammunition and firearm requirements to maximize performance (accuracy and conveying its full energy to the target and resulting in low or no pass-through), safety, and humaneness (shot placement to result in rapid death) (Caudell et al. 2012). The objective of field personnel is to use the fewest number of shots on a target animal, with the intent of a humane and efficient kill with one shot.

For all activities throughout the country, APHIS-WS uses lead-free ammunition when practical, effective, and available to mitigate and/or minimize the effects of its use of lead ammunition on the environment, wildlife, and public health and in compliance with federal, state, territory or tribal regulations on the use of lead ammunition. APHIS-WS evaluates new lead-free ammunition options as they become available. As a federal agency, APHIS takes a cautious approach to ensuring that adverse agency effects are minimized by complying not only with applicable federal laws, but also with state and local laws and regulations for the protection of the environment. Further, WS-Montana adheres to landowner and land manager agreements (WS Directive 2.210; Section 2.4), and therefore would not use lead ammunition in any location where it was so specified within the agreement.

3.10.2.2 What is the Environmental Fate of Lead and its Exposure through Soil and Water Media and Uptake by Terrestrial and Freshwater Plants?

Lead may be introduced to soil and water through WS-Montana IPDM activities in several ways, including if an animal is fatally wounded in an aquatic environment and the body is not retrieved, if ammunition is discharged into aquatic areas, or if shooting predators on land, and either leaving the carcass in the field or the lead passing through the animal.

The average amount of lead used by APHIS-WS nationally is approximately 11,249 pounds or approximately 5 metric tons per year. WS-Montana uses an average of 889.3 pounds of leaded ammunition per year. The amount of lead released into the environment from APHIS-WS activities is less than 0.01% of the amount currently being released into the environment in the United States due to hunting, fishing and industrial activities.

If considered over the amount of land area involved in WS-Montana wildlife damage management during a typical year (average of 11,429,861 acres for FY 2013- FY 2017), the amount of lead distributed from such activities would constitute an average of about 0.0000321507 ppm (mg/kg soil). Natural background levels of lead in soil range from 50-400 ppm (U.S. Environmental Protection Agency 2016) and the threshold for residential soil in a child's play area is 400 ppm (40 CFR 745). Impacts of lead to soils, water, and plants from WS-Montana activities are expected to be negligible.

3.10.2.3 What are the Impacts of Lead on Freshwater and Terrestrial Invertebrates, Amphibians, Reptiles, and Fish?

Although lead from spent ammunition and lost fishing tackle is not readily released into aquatic and terrestrial systems, under acidic environmental conditions it can slowly dissolve and enter groundwater. Risks of this type of impact are greatest near some shooting ranges and at heavily hunted sites, particularly those hunted year after year, and under acidic water and soil conditions with low levels of organic matter. Lead can especially concentrate in aquatic filter feeders and algae (Eisler 1988).

Risk to aquatic ecosystems from WS-Wyoming is expected to be minimal based on the available toxicity data for lead, the potential exposure pathways, and low environmental fate and transport for lead. Risk to aquatic ecosystems including fish, amphibians, invertebrates and plants will occur primarily as lead ammunition either degrades in soil and is transported via runoff, or is directly deposited.

Overall, the potential for lead from WS-Montana wildlife damage management in general and predator damage management activities in particular to cause negative impacts to terrestrial and freshwater invertebrates, amphibians, and fish is negligible.

3.10.2.4 What are the Impacts of Lead on Migratory, Carnivorous, and Scavenging Birds?

Bird sensitivity to lead from exposure to ammunition such as lead shot and bullets, or bullet fragments is well documented. Exposure and risk to nontarget birds is greatest for those that consume animal carcasses killed with lead ammunition. APHIS-WS is shifting to lead-free ammunition as new lead-free alternatives that meet APHIS-WS standards for safety, performance, and humaneness become reliably and cost-effectively available in adequate quantities for program use. Use of lead ammunition by APHIS-WS activities is decreasing over time. The use of non-lead ammunition and pellets by APHIS-WS removes the risk of lead exposure. The potential for lead exposure and risk to scavengers is reduced in situations where carcasses are removed or otherwise rendered inaccessible to scavengers through burial or other approved carcass disposal practices. Consequently, cumulative impacts of APHIS-WS use of lead ammunition would be very low.

3.10.2.5 What are the Impacts of Lead on Terrestrial Mammals and Domestic Animals?

Lead has the potential for adverse effects on a variety of small and large mammal species (The Wildlife Society 2017). The potential for effects on wild and domestic mammals from APHIS-WS activities would be the greatest for mammals that scavenge carcasses containing lead ammunition or that eat crippled animals or gut piles left in the field. Impacts of lead ammunition on populations of scavenging mammals are less clear than studies related to industrial sources of lead. The potential for lead exposure and risk to these types of scavengers is reduced when carcasses are removed and safely disposed of by WS personnel. The current use of non-lead ammunition by APHIS-WS and WS-Montana, when practical, and the transition to effective non-lead alternatives when available and cost-effective, further reduces the already low risk of lead exposure to terrestrial mammals and domestic animals.

3.10.2.6 What are the Risks of Lead to Human Health?

The primary risks of human exposure to lead from WS-Montana actions would be through the consumption of lead ammunition fragments in animal meat. Studies are increasingly showing that lead fragments can be widely dispersed in wild game meat processed for human consumption, even though best attempts are made in the field to remove sections that are within the bullet wound channel (for example, Pain et al. 2009, Golden et al. 2016, National Park Service 2017).

Potential dietary exposure from WS-Montana activities is unlikely, as most carcasses are retrieved for proper disposal, where feasible, and, even if not retrieved in the field, are unlikely to be consumed by humans.

Impacts to human health from WS-Montana's IPDM are very low due to the unlikely consumption of carcasses taken by WS-Montana. Additionally, the risk of contact with lead fragments from WS-Montana activities is minimal.

3.10.2.7 What are the Comparative Impacts of the Alternatives from Lead Used in Ammunition?

3.10.2.7.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

Impacts of lead to soils, water, plants, aquatic species, and invertebrates from WS-Montana sources of lead from IPDM activities are negligible. Impacts of lead to birds and terrestrial mammal populations from WS-Montana sources are low.

The primary contribution of lead is related to ingestion of leaded ammunition by individual animals (direct ingestion of spent ammunition and gut piles and meat for scavenging animals) and humans from eating meat from an animal shot with lead ammunition, as lead bullets fragment into small pieces and spread, making them difficult to contain, find, and avoid in tissue. This is the primary reason for federal and state policies and regulations, and for the choices made by individual hunters to use non-leaded ammunition. Elevated blood lead levels in raptors have been found to contribute to behavioral changes and even death. The status of California condors is possibly dependent on decreased access to lead in carcasses and gut piles. Impacts on humans, especially during early childhood can cause long-term effects on the central nervous system, with behavioral, cognitive, and physiological adverse impacts throughout life. APHIS-WS and WS-Montana use non-leaded ammunition when in accordance with federal and state law and when available, cost-effective, and effective for IPDM purposes.

WS-Montana field personnel dispose of carcasses to make them less accessible to scavengers by putting them under brush, transferring them to MFWP for analysis, placing them in existing carcass pits on private property, or occasionally disposing of them in designated landfills or transfer stations when other methods are not feasible or available. Recreational hunters almost always leave gut piles in the field. Impacts on individual birds and mammals depend on the baseline lead load of an animal, and the volume of lead ingested by each animal from carcasses or gut piles left by WS-Montana employees and hunters in the field. The cumulative load would determine if an individual animal would exhibit behavioral, physiological, or neurological symptoms of lead poisoning. The level of lead available in the environment contributed by WS-Montana through disposal of carcasses with lead and spent ammunition in the field is extremely low in comparison to that deposited from industrial sources and hunters. The overall BBS data shows stable or increasing trends for many species that typically scavenge carcasses, and it is not likely that lead contributed by WS-Montana is impacting any populations.

Risks to human health and safety, including recreationists, hunters and domestic animals, from WS-Montana sources of lead is very low. WS-Montana employees are professionals who routinely follow APHIS-WS directives and standard safety practices, especially the use of PPE and safety requirements, which substantially reduce the risk of major or even minor injury during trapping and snaring activities, based on historical records. Therefore, the risk to field employees is considered very low. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4.

As humans are very unlikely to eat carcasses discarded in the field by WS-Montana, the risk of ingesting lead from WS-Montana activities is negligible. Lead from ammunition would be more likely to be ingested by humans from meat obtained by recreational hunting or, to a very limited degree, from meat donated by WS-Montana. No meat is currently being donated by WS-Montana. Most shots are to a precise area on the animal resulting in a limited distribution of lead fragments through any portion of the edible meat. Therefore, the risk to humans and domestic animals from WS-Montana's use of lead is very low.

3.10.2.7.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4. WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4).

It is possible that the environment, people, domestic animals, and the environment may have fewer exposures to lead in the absence of lethal operational assistance from WS-Montana because there may be fewer entities readily available to help address conflicts, and because individuals experiencing damage may not take action themselves. Conversely, the environment, humans, and domestic animals could be exposed to lead from an increase in IPDM methods and activities by other entities, as a result of greater use of lead shot, more shots per animal taken, and improper carcass disposal. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

WS-Montana would have no effect on the environment, humans, and domestic animals from lead use when not conducting lethal operational assistance. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of mechanical/physical methods, compared to Alternative 1.

3.10.2.7.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Assuming that commercial WCOs are experienced and proficient, effects of lead on the environment, humans, or domestic animals are probably low. However, landowners or other private entities could use more lead, taking more shots per animal, and improperly disposing of carcasses.

Effects on the environment, humans, and domestic animals from WS-Montana's use of lead would be slightly less than Alternative 1. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of lead compared to Alternative 1.

3.10.2.7.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control, including the use of firearms with lead ammunition, could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, gray wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. However, other commercial, governmental, and private entities and landowners would continue to conduct or increase their IPDM activities as described in Section 3.4.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Assuming that commercial WCOs are experienced and proficient, effect of lead on the environment or their safety are probably low. However, landowners or other private entities could use more lead, taking more shots per animal, and improperly dispose of carcasses.

Effects on the environment, humans, and domestic animals from WS-Montana's use of lead would be less than Alternatives 1 and 3. Other entities would be expected to have greater effects on the environment, humans, and domestic animals from the use of lead compared to Alternative 1.

3.10.2.7.5 Alternative 5. No WS-Montana IPDM activities

WS-Montana would have no effect on the environment, humans, and domestic animals from the use of lead. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Assuming that commercial WCOs are experienced and proficient, effect of lead on the environment or their safety are probably low. However, landowners or other private entities could use more lead, taking more shots per animal, and improperly disposing of carcasses.

Therefore, effects on the environment, humans, and domestic animals from the use of lead by other entities would be expected to be higher than under Alternatives 1-4.

3.10.3 What are the Potential Impacts and Risks from the Use of Chemical Methods?

In accordance with WS Directives 2.401 and 2.465 (Section 2.4.1), all hazardous materials and pesticides are applied, certified, stored, transported, shipped, disposed of and use supervised in compliance with applicable federal, State, Tribal, and local laws and regulations. All restricted use pesticides used or recommended by WS-Montana personnel must be registered with EPA and MDA. All hazardous materials and pesticides purchased, stored, and used must be carefully tracked and accounted for. Subject matter included in the annual physical inventories includes security, storage, warning signs, inventory, receipt and transfer of documentation, handling, disposal, immobilization and euthanizing drugs, and pyrotechnics. All storage, transportation, inspections, training, and emergency procedures are conducted according to Appendix 1 of WS Directive 2.401.

3.10.3.1 What are the Potential Impacts and Risks from the Use of Sodium Cyanide in M-44s?

The M-44 is a spring-activated device that delivers a single dose of sodium cyanide powder directly into the mouth, eyes, or nose of targeted animals. It uses a cyanide capsule registered as a restricted use pesticide with the EPA, with APHIS-WS as the principle registration holder (USDA Wildlife Services 2017a). M-44s can only be used by APHIS-WS employees who are trained, certified applicators. The Montana Department of Agriculture also has active long-term FIFRA registrations allowing applicators other than APHIS-WS to apply them (National Pesticide Information Retrieval System 2018).

Each APHIS-WS certified applicator must be trained in the safe handling of the capsule and device, proper placement of the device for safety and selectivity, and necessary recordkeeping. The devices and capsules cannot be sold, transferred, or entrusted to the care of any person not directly supervised by APHIS-WS or an agency working directly under an APHIS-WS or WS-Montana cooperative agreement. However, cooperators under APHIS-WS supervision can monitor deployed M-44s.

The FIFRA label issued by EPA to APHIS-WS for the M-44 device has 26 use restrictions, and state regulatory agencies can require additional restrictions within the state. The label and 26 use restrictions outline required measures to protect threatened and endangered species, public and pet safety, applicator safety, and unintentional/non-target species (Section 2.4.1.6).

M-44 devices are only used in rural public and private settings by WS-Montana for wild canids per EPA and APHIS-WS restrictions (WS Directive 2.415; Section 2.4.1). In Montana, nearly 99% of M-44 use is conducted on private land. M-44s were used in a total of 39 of Montana's 56 counties between FY 13 and FY 17, with an average of 26 counties annually. Over that same time frame the number of counties in which M-44s were placed decreased from a high of 32 counties in FY 13 to a low of 16 counties in FY 17. WS-Montana may use M-44s in other counties when such applications meet the label and the 26 use restrictions (Section 2.4.1.6).

In Montana from FY 2013 through 2017, using an average of 870 capsules per year, an average of 448.4 coyotes per year were taken with M-44s (2,242 coyotes over five years out of a total of 31,933; Tables 2.1 and E.1), and an average of 17 red fox were taken per year with M-44s (85 over 5 years out of a total of 898; Tables 2.1 and E.1), indicating high effectiveness and comparatively low use of the method. Over the five year period use of M-44s in Montana has decreased from a high of 1,179 capsules used in FY 13 to a low of 525 capsules used in FY17. Unintentional M-44 take in Montana between FY 2013 and 2017 was an average of 1.4 annually (Table 3.19) and consisted of 3 red fox, 3 feral or free-ranging dogs, and one gray wolf. WS-Montana did not take any federally-listed threatened or endangered species from 2013 through 2017 by any means.

The risks to human health and safety and the environmental impacts and fate of sodium cyanide in M-44 devices are discussed below and in USDA, APHIS, WS Risk Assessment, Chapter IX: The Use of Sodium Cyanide in Wildlife Damage Management (2017d).

3.10.3.1.1 What are the Potential Impacts on the Terrestrial and Aquatic Environment and Fish from the Use of Sodium Cyanide in M-44s?

Sodium cyanide is soluble in water, and is slowly decomposed by water and rapidly decomposed by acids to give off hydrogen cyanide, a flammable poisonous gas. It volatizes from water surfaces and does not persist in surface waters. Hydrogen cyanide does not bioaccumulate in aquatic or terrestrial or terrestrial organisms (Dzombak et al. 2006). The EPA registration and WS Directive 2.415 (Section 2.4.1) for M-44 devices prohibit its use within 200 feet of a water source.

The toxicity of sodium cyanide and hydrogen cyanide in aquatic environments depends on the size of the water body (degree of dilution), physical and chemical characteristics (temperature, pH, and oxygen concentrations), closeness of the organism to the source of contamination, and the rate of degradation of the cyanide (Towill et al. 1978). Although studies have demonstrated deleterious effects from cyanide in fish (Ketcheson and Fingas 2000), the low risk of a cyanide capsule actually spilling, the small quantity of powdered cyanide in each capsule, and the distance from any water body (at least 200 feet) creates a negligible risk of cyanide poisoning occurring in fish and the aquatic phases of amphibians.

Sodium cyanide from M-44 capsules is released only when an animal of the proper size and strength is able to trigger the device, and the cyanide is released into the animal, not into the environment. An accidental release to the environment of small amounts is restricted to the spill sites and rapidly degrades in soils and volatizes in water. Therefore, the risk of the small amount of sodium cyanide within a single capsule and the restriction of its use within 200 feet of a water source creates a negligible risk to terrestrial and aquatic organisms and water quality.

3.10.3.1.2 What are the Potential Impacts on Non-target Mammals and Birds from Sodium Cyanide in M-44s?

Despite the high toxicity of sodium cyanide to mammals and birds (Wiemeyer et al. 1986, Ketcheson and Fingas 2000, Agency for Toxic Substances and Disease Registry 2006, U.S. Environmental Protection Agency 2010c), and because M-44s are highly selective for wild canids (for example, Shivik et al. 2014; Section 3.9.5.2.1), the risk of non-target wild mammals and birds triggering an M-44 and getting a lethal dose is very low. Seven non-target animals were taken by WS-Montana with M-44 devices during FY 2013- FY 2017, three red fox, 3 feral/free-ranging dogs, and one gray wolf (Table 3.19).

3.10.3.1.3 What are the Potential Risks to Human Health and Safety of the Public, Recreationists, Hunters, and Domestic Animals from Sodium Cyanide in M-44s?

Sodium cyanide forms a gas that is highly toxic to humans when exposed to moisture. Symptoms of acute cyanide exposure includes high blood pressure, rapid heart rate, followed by low blood pressure and slow heart rate, a blue tint to the skin and cherry-red or bloody mucous membranes, pulmonary edema and lung hemorrhage, headaches, dizziness, agitation, dilated and unreactive pupils, convulsions, paralysis and coma, often with increased salivation, nausea, and vomiting (U.S. Environmental Protection Agency 2010a, National Oceanic and Atmospheric Administration 2017). Sodium cyanide is corrosive to the skin and eyes, but exposure of intact skin is less hazardous than exposure through other routes with permeable membranes.

Symptoms of chronic sublethal exposure may include lesions of the optic nerve, depressed thyroid function, and muscle weakness and lack of muscle control. A lethal dose for humans ranges from approximately 0.15 to 0.2 g (0.0068 ounces) for a 150-pound person (U.S. Environmental Protection Agency 2010c).

Per the label, applicators must wear gloves and eye protection to avoid exposures to the eyes and skin.

WS-Montana use of sodium cyanide capsules poses low risk to the public because nearly 99% of WS-Montana M-44 use occurs on private land at the request of the landowner, therefore greatly reducing exposure to the public, recreationists, hunters, and domestic animals. Additionally, Bilingual warning signs are placed at all main access points to areas where M-44s are set, warning any person in the area of the toxic nature of the cyanide and of the danger to pets. Two elevated bilingual warning signs are also placed within 15 feet of each device in the two most likely directions of approach, warning any person in the area of the danger and not to tamper with the devices. Compliance with these M-44 use restrictions, as well as all others detailed in Section 2.4.1, ensure that risks to the public, recreationists, hunters, and domestic animals are minimal.

3.10.3.1.4 What are the Potential Risks to WS-Montana Employees from Sodium Cyanide in M-44s?

The risk to applicators is slightly greater than the risk to the public because applicators handle the devices and capsules as part of their fieldwork. Applicators may be exposed either dermally or through inhalation. Risk from dermal exposure is low, unless the skin is moist or broken due to a wound or scratch. An LD_{50} for hydrogen cyanide adsorption through the skin is 100 mg/kg (100 ppm; Isom 1993). Moving away from the point source is unlikely to reduce the risk to applicators because hydrogen cyanide is lethal to humans at low concentrations and reacts rapidly in the human body. The symptoms of cyanide exposure may also interfere with the person's mobility.

From FY84 to FY15, 25 exposures to sodium cyanide involved WS employees as reported on WS 6(a)(2) Adverse Effects Incident Information Reports. None involved lethal cases. The majority of APHIS-WS exposures were from accidental discharges that occurred while employees were setting, inspecting, or pulling M-44s; only one discharge was due to an improper action of an employee involving transporting a set M-44 from one location to another (USDA Wildlife Services 2017d). No WS-Montana employee has been injured by using M-44s.

The risk to WS-Montana certified applicators is low as applicators receive proper training in the product's use, follow label instructions, wear protective clothing, including gloves and eye protection. Use of M-44 devices by WS-Montana employees is decreasing.

3.10.3.2 What are the Impacts and Risks of Sodium Nitrate as Used in Gas Cartridges?

Gas cartridges are pyrotechnic fumigants used to target animals that live in burrows or dens, such as coyotes, skunks, and badgers. The cartridges contain the active ingredients sodium nitrate ($NaNO_3$) and charcoal, combined with two inert ingredients, Fuller's earth and borax. The sodium nitrate supports the combustion of the charcoal, which emits carbon monoxide (CO) during the burning, as well as lesser chemicals, such as sodium carbonate (Na_2CO_3 and nitrogen gas (N_2). The Fuller's earth and borax control the rate of the burn. After clearly identifying the species currently using the den as required by the label and before treating an active burrow or den of the target species, the certified applicator blocks all identifiable den or burrow openings so that the CO is fully enclosed in the den. The cartridges are cardboard tubes with cardboard caps that are punctured just prior to use, the fuse inserted into the end of the tube containing the formulation, the fuse is lit, inserted deep into the burrow, and the opening to the burrow blocked to provide for sufficiently high levels of CO to be rapidly lethal. One or two cartridges may be used, depending on the size of the animal and burrow, including burrows suspected to have multiple runways.

The CO created by the combustion of sodium nitrate and charcoal is a clear odorless, colorless gas and poisonous to all animals that use hemoglobin to transport oxygen from the lungs to the cells of the body because the carbon monoxide attaches to the hemoglobin, replacing oxygen and causing the animal to quickly suffocate. The American Veterinary Medical Association (2020) recommends the use of CO for euthanasia because it quickly induces unconsciousness without pain, and death occurs rapidly (Section 3.9.5.2.2).

Sodium nitrate dissolves in moist air and is very soluble in water. Charcoal is created from charring peat or wood into a solid or powder and is non-hazardous, biodegrading in the environment. It is not soluble in water, and is stable unless exposed to an ignition source, whereupon it creates CO. CO is flammable and highly toxic, and is also created by burning fossil fuels for energy and vehicles (U.S. Environmental Protection Agency 2010b). Sodium carbonate is also created by the burning process, is naturally occurring in soil and water, and is used to make glass and soaps. Nitrogen gas (N_2) is a byproduct of the combustion, occurs naturally in the environment, and comprises 78% of the earth's atmosphere. Fuller's earth is a natural clay material and borax is a salt that is a common ingredient in detergents and cosmetics.

The EPA registration is a general use or not restricted use pesticide for use by any member of the public over the age of 16, similar to any other pesticide available for retail sale.

The cardboard cartridge burns in the burrow or degrades when exposed to soil moisture. Sodium nitrate that is not burned is not volatile and remains as a particulate in the soil until it degrades through microbial activity, converting it to N_2, which enters the nitrogen cycle and does not produce any hazards. Burning sodium nitrate creates simple organic and inorganic compounds, mostly in the form of gases, which diffuse through the soil. Sodium carbonate dissociates in water to sodium, a salt, and carbonate ions, neither of which adsorb on soil particles or bio-accumulate in living tissues. The CO created by burning charcoal in the burrow is inhaled by the animals, degraded by soil microorganisms, is converted to carbon dioxide, or fixed by bacteria (Agency for Toxic Substances and Disease Registry 2012).

Because these chemicals are widespread and naturally occurring in the environment, are localized inside the burrows, and impacts are negligible, EPA waived the requirement for conducting environmental fate studies (U.S. Environmental Protection Agency 2008).

The method is often recommended in the literature for taking coyote pups to reduce the potential that the alpha pair will cause livestock depredations to provision the pups (Section 1.12.4.2). It is the only way to be certain that the alpha pair is being targeted, and studies have suggested that the alpha pair may start or increase livestock depredation during the pupping season in the spring that overlaps with the lambing or calving season for providing ready and sufficient food for growing pups. Removing the pups removes the need to provision the pups, typically resulting in reducing livestock depredation.

WS-Montana uses gas cartridges sparingly during IPDM activities, primarily on coyote and red fox dens (Table E.1).

Further details on the risks to human health and safety and the environmental impacts and fate of carbon monoxide from gas cartridges and forced gas fumigation systems are found in the following sections and in USDA, APHIS, WS Risk Assessment, Chapter VIII: The Use of Carbon Monoxide from Gas Cartridges and Forced Gas Fumigation Systems in Wildlife Damage Management (2017e). Predator burrows are easy to identify based on tracks, observed activity, and presence of scat. The risk of non-target birds or mammals co-occurring in an active predator burrow is very low, as they could become readily accessible prey. It is highly unlikely that another bird or mammal would co-occur with a skunk in a burrow. The potential risk to the environment from the component chemicals and resulting chemicals after pyrolysis is minimal. The potential to take non-target species when using gas cartridges for coyote or fox is very low.

3.10.3.2.1 What are the Potential Risks to the Public, Recreationists, Hunters, and Domestic Animals from Sodium Nitrate as Used in Gas Cartridges?

Sodium nitrate is an eye irritant and can irritate the skin. Acute oral toxicity is very low, with the LD_{50} for domestic rabbits at 2,680 mg/kg respectively (Organization for Economic Co-operation and Development 2007). Sodium carbonate has low toxicity to humans and low or no skin irritation potential (Organization for Economic Co-operation and Development 2002). CO rapidly causes asphyxiation and death.

All components and combustion byproducts are enclosed in the cardboard gas cartridges that are further enclosed in sealed burrows, and the applicators conduct burrow treatments when no people are present. Therefore, the risk for health and safety impacts and impacts on a recreational or hunting experience are minimal.

3.10.3.2.2 What are the Potential Risks to APHIS-WS and WS-Montana Field Employees from Sodium Nitrate as Used in Gas Cartridges?

Exposure risk for WS-Montana gas cartridge applicators has the potential to be higher than for the public, recreationists, hunters, and domestic animals because the employees actually handle the gas cartridge. Because gas cartridges are ignited using a timing fuse, the applicator has sufficient time to move away before ignition occurs and CO is created.

All components and combustion by-products are enclosed in cardboard gas cartridges that are enclosed in sealed burrows. No APHIS-WS or WS-Montana employee has been injured by using gas cartridges. These cartridges are used by WS-Montana an average of 31 times a year (Table E.1). Therefore, the risk of any adverse impacts to WS-Montana employees is minimal.

3.10.3.3 What are the Potential Impacts and Risks from Use of DRC-1339?

Common name DRC 1339 ($C_7H_9CI_2N$, CAS No. 7745-89-3) 3-chloro-p-toluidine hydrochloride (synonyms: 3-chloro-4-methylbenzenamine hydrochloride, or 3-chloro-4 methylaniline hydrochloride) is a slow acting avicide used to address starling, pigeon, blackbird, corvid, and gull damage. This restricted use chemical is used by the APHIS-WS to reduce bird conflicts at livestock facilities and airports, and to reduce damage to crops, livestock, property, and natural resources, including threatened and endangered species, per label allowances. WS-Montana utilizes DRC-1339 to manage raven populations that are damaging livestock, species of concern, or pose a risk to human health and safety. This toxicant is often injected into boiled eggs or applied to dog food and placed at the site where the damage is occurring (Peebles and Conover 2016).

Some individuals have expressed concerns that they believe that the use of DRC-1339 could adversely affect people and pets from direct exposure or indirectly from birds that have died from chemical use. The use of DRC-1339 is regulated under FIFRA and Montana pesticide laws by EPA and MDA, and applied by WS-Montana under their management and in accordance with labeling and WS Directives. APHIS-WS applicators are certified by the State and must complete a written examination and undergo recurrent training (USDA Wildlife Services 2019f).

Following the consumption of a lethal dose, DRC-1339 kills target bird species within 3 to 80 hours (Dawes 2006). Prior to death, DRC-1339 is partially to mostly metabolized (Schafer Jr. 1984). In treated birds, DRC-1339 causes renal failure that results in weight loss, depression, lethargy, increased thirst and urination, dehydration, articular gout, and eventually culminates in death (Merck Veterinary Manual 2018). Birds that consume lethal doses may appear asymptomatic (showing no physical signs of distress) for many hours following chemical ingestion. Typically, in the hours before death (~4 hours), birds cease to eat or drink and become listless, inactive, and may appear comatose (Dawes 2006). Although acutely toxic to many pest bird species, this chemical appears to pose little risk of secondary poisoning to nontarget animals, including avian scavengers (Cunningham et al. 1979, Schafer Jr. 1984, Knittle et al. 1990).

Between FY13 and FY 17 WS-Montana used only 26.4g of DRC-1339 in response to raven damage; an average of 5.28g annually (MIS 2020). All applications of DRC-1339 for ravens took place on private land. The low-level of use and location of application further reduce adverse impacts and risks.

3.10.3.3.1 What are the Potential Impacts on the Terrestrial and Aquatic Environment and aquatic nontarget organisms from the Use of DRC-1339?

In general, DRC-1339 rapidly degrades in the environment following operational application. When exposed to sunlight or ultraviolent radiation DRC-1339 has an average degradation half-life (in soil) of 0.17 days based on soil type (USDA Wildlife Services 2019f). In Texas loam soil DRC-1339 has a half-life of 0.02 days in LAD clay soil (USDA Wildlife Services 2019f). DRC-1339 rapidly and irreversibly binds to soil organic matter suggesting that the volatilization of the chemical from the soil into the atmosphere is not a likely pathway for exposure. Similarly, it appears that DRC-1339 has a low potential for volatilization into the atmosphere from aqueous solutions due to its moderate vapor pressure (1.06 x 10-4 torr at 25 ° C) and a high Henry's Law constant value (~1.47 x 10-8 atm-m3-mol-1). Due to its high affinity to soil organic matter it has a low potential for migration into groundwater and surface water sources (USDA Wildlife Services 2019f).

Uptake by plants is unlikely because DRC-1339 is generally injected into hard-boiled eggs and placed away from vegetation. Any DRC-1339 that would leach from the bait material would degrade quickly in soil or bind to soil organic matter reducing bioavailability to plants. In addition, most of the bait is removed by the target species reducing the amount of DRC-1339 available for any potential plant uptake.

In water, DRC-1339 is highly soluble, resistant to hydrolysis, sensitive to light, and has a half-life ranging from 6.5 to 41 hours depending on season. Depending on the season applied, DRC-1339 will degrade more rapidly in summer months than in winter (U.S. Environmental Protection Agency 2011). DRC-1339 is not expected to bioconcentrate in aquatic environments. In field trials, bluegill fish exposed to DRC-1339 have an average bioconcentration factor of 33x (edible tissues), 150x (in non-edible tissues), and 88x (whole fish) (Spanggord et al. 1996, U.S. Environmental Protection Agency 2018).

Concerns have been specifically raised concerning the risk of environmental contamination from application of DRC-1339 and toxicity exposure to aquatic organisms from carcasses of birds killed with DRC-1339. Aquatic exposure from proposed DRC-1339 applications is expected to be low based on the method of application, proposed use pattern and mitigation measures to protect aquatic resources. The current use restrictions for the Bird Control and LNF labels require a 50-foot "No-treatment" application buffer from manmade and natural water bodies that will reduce the potential for DRC-1339 to enter water bodies from runoff. Drift is not a potential pathway for exposure because applications are made as a bait and only broadcast in limited applications. No applications are allowed on either label using aerial application equipment, further reducing the potential for any off-site transport (USDA Wildlife Services 2019f).

The risk to the aquatic and terrestrial environments from the use of DRC-1339 is minimal due to the method of application, label requirements for removal of unused bait and carcasses, and "No treatment" buffers adjacent to aquatic habitats. Ecological risks to aquatic nontarget organisms are low based on the use pattern, available toxicity data and labeled mitigation measures designed to reduce exposure to aquatic habitats. Risks to terrestrial invertebrates and plants are also low based on available effects data and the method of application.

3.10.3.3.2 What are the Potential Impacts on Non-target Mammals and Birds from DRC-1339?

WS-Montana personnel are highly experienced and trained to select the most appropriate method(s) for taking problem birds with minimal impacts on non-target species. The DRC-1339 label instructions ensure little effect on non-target avian and mammalian species in Montana. For example, DRC-1339 baits cannot be used in areas where potential consumption of treated baits by T&E species could occur and observation of sites to be treated with or without prebaiting is necessary to determine the presence of non-target species. DRC-1339 baits cannot be used directly in water or areas where runoff is likely. WS-Montana retrieves birds taken to the extent possible following the use of bait treated with DRC-1339. WS-Montana also removes all unconsumed, regurgitated, or spilled toxic bait at the conclusion of the treatment period.

The acute risk to non-target birds and mammals under field use can be reduced depending on the application method, removal of bait by the target species, and other measures, some of which are stated on the DRC-1339 labels (USDA Wildlife Services 2019f). Prebaiting also reduces the risk to nontarget wildlife by increasing target species acceptance of the bait and ensures that nontarget species are not feeding on the bait. The low risk to most nontarget species has been validated by field data where little to no nontarget carcasses have been observed or collected during and after baiting (Smith 1999, Cummings et al. 2002) . WS-Montana field personnel record nontarget species take and collect this information during and after baiting operations. Between FY13 and FY17 WS-Montana reported no non-target take from the use of DRC-1339 (MIS 2020).

Secondary poisoning risks are expected to be low based on the rapid metabolism of DRC-1339 in birds and low residues that have been observed post treatment. (Johnston et al. 1999) demonstrated the low potential for secondary poisoning in various avian and mammalian scavengers and predators based on measured residues in boat-tailed grackles. Between FY13 and FY17 WS-Montana did not observe or receive reports of secondary poisoning as a result of the use of DRC-1339.

DRC-1339 is a slow acting avicide that is metabolized or excreted in birds and mammals within a matter of hours. DRC-1339 poses little risk of secondary poisoning to nontarget animals, including avian scavengers. Nontarget birds and mammals that are sensitive to DRC-1339 may be at risk to DRC-1339, but this risk can be reduced through label language designed to reduce exposure.

3.10.3.3.3 What are the Potential Risks to the Public, Recreationists, Hunters, and Domestic Animals from DRC-1339?

DRC-1339 is hazardous to human health because of its acute inhalation toxicity and eye and skin corrosiveness. Pesticide label statements regarding the health effects based on toxicity studies include “Fatal if inhaled. Corrosive. Causes irreversible eye damage and skin burns. May be fatal if swallowed. Harmful if absorbed through skin. Prolonged or frequently repeated skin contact may cause allergic reactions in some people.” (U.S. Department of Agriculture 2016;2017a;b). The chemical is more than 90% metabolized in target birds within the first few hours after they consume the bait. Therefore, little material is left in bird carcasses that may be found or retrieved by people and a human would need to ingest the internal organs of birds found taken with DRC-1339 to be exposed.

Although the hazard potential could be high, the anticipated minimal exposure to this pesticide will be low risk due to the limited use of the product and implementation of use restrictions. At application sites entry restrictions only allow protected applicators in the area during application. Persons other than authorized handlers must stay away from the treated area at all times, and domestic animals must be kept away from the treated area. Between FY 13 and FY 17 all DRC-1339 use for common ravens took place on private land, even further reducing exposure to the public, recreationists, hunters, and domestic animals. Exposure is greatest for workers who mix the product with a bait material. The potential exposure and risk to the general public is low due to the use pattern and label restrictions, as well as lack of dietary exposure through food or drinking water. APHIS-WS is unaware of any exposure to the general public from 1987 to present (USDA Wildlife Services 2019f).

3.10.3.3.4 What are the Potential Risks to APHIS-WS and WS-Montana Field Employees from DRC-1339?

USDA APHIS evaluated the potential human health and ecological risks from the proposed use of DRC-1339 to control bird damage. DRC-1339 is corrosive to eyes and skin and the acute inhalation toxicity is unknown, but assumed to be Category I (most hazardous) by EPA. Although the hazard potential could be high, the anticipated minimal exposure to this pesticide will be low risk due to the limited use of the product. Exposure is greatest for workers who mix the product with a bait material; however, required personnel protective equipment results in a low potential for exposure and risk when factoring in available health effects. The potential exposure and risk to WS-Montana field employees is low due to the use pattern and label restrictions, as well as lack of dietary exposure through food or drinking water. WS is unaware of any exposure from 1987 to present to WS personnel (USDA Wildlife Services 2019f).

3.10.3.4 What are the Potential Impacts and Risks from Use of Immobilization and Euthanasia (Humane Killing) Drugs?

Immobilization and euthanasia (I&E) chemicals are described in Appendix A and evaluated for humaneness in Section 3.9.5.2.

WS Directives 2.505 and 2.430 (Section 2.4) provide guidance for euthanizing and immobilizing animals. All WS-Montana personnel using I&E drugs must undergo full training and certification as described in WS Directive 2.430. Only I&E drugs approved by the APHIS-WS I&E committee may be used by APHIS-WS personnel, unless under emergency situations. Attachment 1 of WS Directive 2.430 lists the approved I&E drugs. Under an emergency situation, a drug not listed in Attachment 1 may be used, but only when approved on a one-time or limited basis by an attending/consulting veterinarian and the State Director or designee, provided that such use is in compliance with all applicable laws.

Immobilization drugs are eliminated from wildlife over time by being excreted unchanged (usually in the urine or bile), or chemically metabolized and broken down by wildlife through natural metabolic processes. Some animals, such as a bear, could be immobilized just prior to or during a hunting season. In the event that WS-Montana is requested by MFWP to immobilize a bear during a period of time where the drug withdrawal period could overlap with a regulated harvest season, WS-Montana would either euthanize the bear or mark the animal with ear tags instructing the hunter to contact MFWP before consuming the animal. Withdrawal periods for commonly used drugs can be found on the Western Association of Fish and Wildlife Agencies Wildlife Heath Committee website (Western Association of Fish and Wildlife Agencies and Wildlife Health Committee 2010). This measure minimizes the risk of human exposure to residual immobilization drugs in the likelihood that they harvest a recently immobilized animal (Section 2.4.3.1).

WS Directive 2.515 (Section 2.4) directs that animals euthanized with drugs such as sodium pentobarbital (Beuthasia D) that may pose secondary toxicity hazards to scavengers must be disposed of according to federal, state, county, and local regulations, drug label instructions, or, lacking such guidelines, by incineration or at a landfill approved for such disposal.

Inventories of all I&E drugs are conducted at least once per year for correct storage, inventory management, and documentation to ensure that all drugs purchased are accounted for (WS Directive 2.465; Section 2.4).

WS-Montana uses very few I&E drugs. Euthanasia is primarily performed by shooting at close range. There is a potential that projectile dart containing immobilization chemicals could miss the animal and be lost. Immobilization drugs are applied only when an animal must be transferred/transported safely and humanely or when captured in a public area with high visibility, both of which are rare. Immobilization would occur primarily for bear and mountain lion under limited and MFWP-approved circumstances; all other animals are euthanized per state law and regulation and state and APHIS-WS policies. The immobilization drug would be administered directly by either hand syringe, pole syringe, or dart gun at close range (Appendix A).

3.10.3.4.1 What are the Overall Environmental Impacts and Health and Safety Risks Associated with Use of I&E Drugs?

As only small amounts of I&E drugs are used by WS-Montana in a year, a highly trained field employee performs any use of drugs. Drugs are typically administered at close range or by hand. There is a potential for a projectile immobilization dart to miss its target and become lost. However, due to the very limited potential of this occurring, and the degradation of the chemical over time, there is negligible risk to release into the environment and or risk to the public from accidental exposure. Also, as all drugged animals are either marked or disposed of in compliance with law and APHIS-WS policy. Therefore, the risk of adverse impacts from I&E drugs on the environment, animals, the public, recreationists, hunters, and WS-Montana field employees is negligible. MFWP, USFWS, or other agencies are likely the only ones to use I&E drugs, and will have the necessary training, expertise, and protocols (similar to WS-Montana) to minimize effects on the environment, humans, and domestic animals.

3.10.3.5 What are the Comparative Impacts of the Alternatives from the Use of Chemical Methods?

3.10.3.5.1 Alternative 1. Proposed Action/ No Action Alternative: Continue WS-Montana IPDM Assistance

M-44s: EPA's use restrictions minimize the risk of impacts on the environment from M-44s. The risk to WS-Montana employees is low because all certified APHIS-WS employees must demonstrate their proficiency in the safe and effective use of M-44s consistent with the label restrictions, and their field supervisor conducts at least one field inspection a year for verification. All applicators receive proper training in the product's use, follow label instructions, and wear PPE (including gloves and eye protection). All sodium cyanide capsules not deployed in a device are always locked and secured at all times, restricting the potential for a person to contact an isolated sodium cyanide capsule. No WS-Montana employee has been injured by using M-44s.

WS-Montana's compliance with EPA use restrictions also minimizes the risk to the public. For example, per the EPA registration, 26 use restrictions, and APHIS-WS directive (Section 2.4.1.6), the setting of M-44s is restricted in recreation areas, areas where exposure to the public and pets is probable, and from wilderness areas. Additionally, setting of M-44s is limited to areas within seven miles of properties where livestock losses have occurred (when used for protecting livestock) and are removed from an area if after 30 days there has been no sign that the target animal has visited the area.

Any use of M-44s on federal land must be documented and a Pesticide Use Proposal must be approved by the federal land management agency. Label restrictions also limit the potential for humans or domestic animals to encounter a device set on public land. On private land, use of M-44s requires the consent of the landowner, who is requesting the use of M-44s. APHIS-WS will notify the owner of lessee occupying any residence at or near 0.5 mile perimeter of an M-44 device of their use in the area. On all lands with M-44s set, two bilingual device signs are placed within 15 feet of the device. Additionally, entry signs are placed to alert the public to the presence of M-44 devices and warn not to tamper with them. Individuals in remote areas away from paths or trails may encounter an M-44, but the risk is low, given that EPA requires that a maximum of 10 to 12 devices may be placed in any one square mile.

As described in Section 3.4, the risk to the public is further minimized because the EPA label restricts the use of M-44s to certified and licensed pesticide applicators, who are required to follow the label restrictions. The products are not commercially available to the public. WS-Montana complies with the use restrictions on the product label.

A person finding a dead coyote is highly unlikely to either eat it or let their pet dog eat it. Any cyanide in the carcass would be distributed throughout tissues, resulting in low potential for any lethal dose to be obtained from scavenging on a carcass. A sub-lethal dose obtained by a dog would break down into a nontoxic chemical and be excreted in the urine within twelve hours.

WS-Montana's compliance with the EPA use restrictions also minimizes the risk to non-target species. The small amount of sodium cyanide within a single capsule, and the restriction of its use within 200 feet of a water source, result in a negligible risk to terrestrial and aquatic organisms and water quality. The selectivity of M-44s to canids and low use by WS-Montana indicate that there is low risk of non-target wild mammals and birds triggering an M-44 and getting a lethal dose. The fate of sodium cyanide and hydrogen cyanide in the environment suggest the cyanide from a capsule would undergo biotic and abiotic degradation to non-lethal compounds.

Therefore, the risk to the environment, humans, and domestic animals is very low when used according to the restrictions in the EPA label and APHIS-WS directives.

Sodium nitrate: The risk of impacts on the environment, humans, and domestic animals from sodium nitrate (gas cartridges) is negligible because the chemical has low toxicity and is used entirely within an enclosed burrow. No APHIS-WS or WS-Montana employee has been injured by using gas cartridges, and the use of these cartridges by WS-Montana field personnel is infrequent.

DRC-1339: The risks to aquatic and terrestrial environments, non-target species, the general public, and WS-Montana employees from the use of DRC-1339 are minimal due to the low-level of use, method of application, label requirements for removal of unused bait and carcasses, and "No treatment" buffers adjacent to aquatic habitats. Ecological risks to aquatic nontarget organisms are low based on the use pattern, available toxicity data and labeled mitigation measures designed to reduce exposure to aquatic habitats. Risks to terrestrial invertebrates and plants are also low based on available effects data and the method of application.

I&E Drugs: Only small amounts of I&E drugs are used by WS-Montana in a year, and only highly trained field employees administer I&E drugs. Drugs are administered at close range or by hand, resulting in negligible effects on the environment, people, and domestic animals. Also, as all drugged animals are either marked or disposed of in compliance with law and APHIS-WS policy, the risk of adverse impacts on the environment, animals, the public, recreationists, hunters, and WS-Montana field employees is negligible.

Therefore, based on detailed risk assessments (USDA Wildlife Services 2017d;e;2019f) and the incorporation of protective measures (Section 2.4), the analysis of impacts on soil, water, and terrestrial and aquatic species indicates there would be little to no effect on the environment from WS-Montana's use of chemical methods. Additionally, risks to humans and domestic animals from WS-Montana's use of chemical methods are very low to negligible due to protective measures (Section 2.4).

3.10.3.5.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4. WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. WS-Montana would only be able to use immobilization drugs under this alternative.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent.

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. However few individuals would likely have the training and authorization to utilize chemicals that WS-Montana could use under Alternative 1. Under this alternative, M-44s would only be used by private applicators that are licensed and certified by MDA. DRC-1339 is a restricted use pesticide and is not available for public use at this time. It is possible for private individuals to get the required training and to work with a license veterinarian in order to utilize immobilization and euthanasia chemicals. However, private individuals are not as likely to have the training and authorization to use immobilization and euthanasia drugs. Although some WCOs may have training and authorization to use immobilization and euthanasia drugs, it is not common that WCOs will have access to them. MFWP, USFWS, or other agencies are likely the only ones to use I&E drugs, and will have the necessary training, expertise, and protocols (similar to WS-Montana) to minimize effects on the environment, humans, and domestic animals. Sodium nitrate in large gas cartridges isn't a restricted-use pesticide and could be used by private individuals and or public agencies. If used, applicators would be required to follow the label restrictions from the EPA, and follow ESA guidelines for minimizing risks to the environment, people, and domestic animals.

Effects on the environment, humans, and domestic animals from WS-Montana's use of chemical methods would be less than Alternative 1. Because chemical methods are limited for use by other entities, effects on the environment, humans, and domestic animals from the use of chemical methods by other entities would be less than under Alternative 1.

3.10.3.5.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However few individuals would have the training and authorization to utilize chemicals that WS-Montana could use under Alternative 1. Under this alternative, M-44s would only be used by private applicators that are licensed and certified by MDA. DRC-1339 is a restricted use pesticide and is not available for public use at this time. Private individuals are not likely to have the training and authorization to use immobilization and euthanasia drugs and it is unlikely that WCOs will have access to them. MFWP, USFWS, or other agencies are likely the only ones to use I&E drugs, and will have the necessary training, expertise, and protocols (similar to WS-Montana) to minimize effects on the environment, humans, and domestic animals. Sodium nitrate in large gas cartridges isn't a restricted-use pesticide and could be used by private individuals and or public agencies. If used, applicators would be required to follow the label restrictions from the EPA, and follow ESA guidelines for minimizing risks to the environment, people, and domestic animals.

Effects on the environment, humans, and domestic animals from WS-Montana's use of chemical methods would be slightly less than Alternative 1. Because chemical methods are limited for use by other entities, effects on the environment, humans, and domestic animals from the use of chemical methods by other entities would be less than under Alternative 1.

3.10.3.5.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4.

During (or instead of) WS-Montana's limited lethal assistance, landowners could still choose to address the problem by implementing IPDM methods themselves. Landowners could use trained and experienced WCOs or may implement lethal methods themselves.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However few individuals would have the training and authorization to utilize chemicals that WS-Montana could use under Alternative 1. Under this alternative, M-44s would only be used by private applicators that are licensed and certified by MDA. DRC-1339 is a restricted use pesticide and is not available for public use at this time. Private individuals are not likely to have the training and authorization to use immobilization and euthanasia drugs and it is unlikely that WCOs will have access to them. MFWP, USFWS, or other agencies are likely the only ones to use I&E drugs, and will have the necessary training, expertise, and protocols (similar to WS-Montana) to minimize effects on the environment, humans, and domestic animals. Sodium nitrate in large gas cartridges isn't a restricted-use pesticide and could be used by private individuals and or public agencies. If it is used, applicators would be required to follow the label restrictions from the EPA, and follow ESA guidelines for minimizing risks to the environment, people, and domestic animals.

Effects on the environment, humans, and domestic animals from WS-Montana's use of chemical methods would be less than Alternatives 1 and 3. Because chemical methods are limited for use by other entities, effects on the environment, humans, and domestic animals from the use of chemical methods by other entities would be less than under Alternative 1.

3.10.3.5.5 Alternative 5. No WS-Montana IPDM Activities

WS-Montana would have no effect on the environment, humans, and domestic animals from the use of chemical methods. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities.

Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent.

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. However few individuals would have the training and authorization to utilize chemicals that WS-Montana could use under Alternative 1. Under this alternative, M-44s would only be used by private applicators that are licensed and certified by MDA. DRC-1339 is a restricted use pesticide and is not available for public use at this time. Private individuals are not likely to have the training and authorization to use immobilization and euthanasia drugs and it is unlikely that WCOs will have access to them. MFWP, USFWS, or other agencies are likely the only ones to use I&E drugs, and will have the necessary training, expertise, and protocols (similar to WS-Montana) to minimize effects on the environment, humans, and domestic animals. Sodium nitrate in large gas cartridges isn't a restricted-use pesticide and could be used by private individuals and or public agencies. If it is used, applicators would be required to follow the label restrictions from the EPA, and follow ESA guidelines for minimizing risks to the environment, people, and domestic animals.

Because chemical methods are limited for use by other entities, effects on the environment, humans, and domestic animals from the use of chemical methods by other entities would be less than under Alternative 1.

3.11 What are the Effects of WS-Montana IPDM on Special Management Areas?

A number of different types of Federal lands occur within the analysis area such as Wilderness Areas (WAs), Wilderness Study Areas (WSAs), National Conservation Lands, National Historic Sites, Wild and Scenic Rivers, Areas of Critical Environmental Concern, and Recreation Management Areas (RMAs). All of these land types currently have special designations because of their unique characteristics and may require special considerations for conducting PDM. These are collectively referred to as Special Management Areas (SMAs). WS-Montana recognizes that some persons interested in SMAs may feel that any PDM activity in these areas adversely affects aesthetics, natural qualities, values, or the ecosystem. Many do not realize that many SMAs have allowed grazing since long before their designation as an SMA, and continue to allow it. Current laws and regulations allow the public and WS-Montana to conduct PDM activities in SMAs under certain limitations. As such, WS-Montana has conducted PDM on some of these areas. However, PDM on SMAs occurs on very few grazing allotments, which are generally small proportions of the total area of the SMA, for the protection of livestock. In recent years WS-Montana PDM on SMAs has been minimal, and we do not anticipate any substantial increase in the future. PDM in SMAs is only a very minor component of the current PDM program. WS-Montana complies with internal guidelines and policies when conducting PDM in these areas. WS-Montana also abides by all federal and state laws, regulations, and policies set forth for these SMAs (e.g., the Wilderness Act) to minimize any adverse effects on the area. Currently, private individuals using firearms and trail hounds can sport hunt or conduct PDM in most SMAs under MFWP regulations. These activities are not restricted by BLM or USFS in most SMAs.

WS-Montana recognizes that some individuals interested in SMAs may feel that any PDM activities in these areas adversely affect their aesthetic and natural qualities, value, and the ecosystem. This issue was discussed in Chapter 2, as well as WS-Montana's protective measures to ensure no adverse effects in SMAs. WS-Montana abides by all associated laws, regulations, and policies (e.g., the Wilderness Act) to minimize any effect on the public while conducting PDM as allowed to reduce damage in the SMAs or surrounding areas. WS-Montana also complies with APHIS-WS guidelines and policies when conducting PDM in these areas. PDM is only conducted in designated WAs or WSAs when allowed by the legislation that designated the WA, or under regulations and policies developed by the land management agency for PDM in these areas. WS-Montana has not conducted a minimum requirements analysis for protection of livestock from predation in wilderness areas, because minimum requirements analyses are normally conducted by the land management agencies (e.g. USFS or BLM).

WS-Montana generally conducts PDM on only a few SMA grazing allotments for the protection of livestock. The Current Program Alternative has a minimal effect on SMAs, such as WAs, WSAs, and RMAs (such as campgrounds and trailheads).

WS-Montana's work in WAs and WSAs may range from no activity to seasonal IPDM activities, based upon requests for assistance. While requests for assistance in WAs and WSAs occur on an infrequent basis, the potential exists that WS-Montana may be requested to work almost anywhere in the state, including WAs and WSAs. When requested, WS-Montana would follow all applicable laws, APHIS-WS policies, MOUs, regulations, AWPs, Minimum Requirement Analyses (MRAs), and land management agency policies. WS-Montana coordinates all activities in WAs and WSAs with the appropriate land management agencies in Annual Work Plans.

BLM SMAs: WS-Montana PDM in WAs, WSAs, RMAs, and other SMAs conforms with all federal and state laws and regulations that have been determined to apply to WS-Montana activities. WS-Montana PDM in SMAs has occurred only to a very minor degree in the current program and the need for such activity in SMAs is expected to remain minor. The AWPs between BLM and WS-Montana contains stipulations for PDM in SMAs including traveling on existing roads and trails and permits only targeted removal of offending individuals in BLM WSAs. The BLM has not imposed any restrictions on most PDM methods in SMAs in the State. Therefore, the use of such methods under WS authorities would be consistent with BLM management direction in such areas.

WS-Montana coordinates annually with the BLM, which provides the BLM with the opportunity to identify any conflicts that WS-Montana activities might have with established management plans, MRAs, or goals for SMAs. If WS-Montana activities are found to conflict with such management plans or goals, then WS-Montana will either avoid conducting the activity or engage in further NEPA analysis as appropriate in coordination with the BLM.

USFS SMAs: WS-Montana follows policies outlined in the USFS Manual, particularly Section 2323, and the National MOU between USFS and WS-Montana when conducting PDM in USFS SMAs such as WAs and WSAs. Additionally, the Land Resource Management Plan provides guidance for USFS to determine if PDM objectives are compatible with land management objectives. For example, WS-Montana does not conduct PDM in USFS specially designated areas (e.g., trailheads, campgrounds), except for emergency human health situations. Proposed WS-Montana PDM plans are reviewed by USFS during the work planning process annually to ensure that there are no conflicts with the Land Resource Management Plan or MRAs. Therefore, we expect no potential for WS-Montana PDM to have any adverse effect on wilderness characteristics or management objectives of SMAs. Proposed PDM in USFS SMAs is primarily limited to grazing allotments with a limited buffer zone for the protection of livestock but could also occur on occasion for the protection of threatened and endangered species if requested by USFWS and MFWP. PDM in SMAs would not impair the values of such areas and the intent of Congress designating them as such.

Summary of Potential Impacts to SMAs in Montana: Montana has many SMAs, spanning millions of acres throughout the state. A list of SMAs in Montana is provided in Table 3.20 below. These areas were analyzed to determine potential impacts of the current WS-Montana program on their unique characteristics. The various SMAs are managed for the protection of certain qualities or values such as biological (e.g., sensitive plant or animal species), ecological (e.g., riparian, rangeland), cultural, historical, scenic, geological, paleontological, or recreational. Many of these resource values do not have the potential to be impacted by the PDM methods that WS-Montana might use on such areas (e.g., aerial PDM, ground-based shooting).

Table 3.20. Special Management Areas in Montana (list is not intended to be comprehensive).

WILDERNESS AREAS / NATIONAL PARKS / NATIONAL MONUMENTS / HISTORIC SITES / NATIONAL TRAILS / WILD AND SCENIC RIVERS /WILDLIFE REFUGES / BACKCOUNTRY CONSERVATION AREAS		
Absaroka-Beartooth Wilderness Area (USFS)	Upper Missouri Breaks Nat'l Monument (BLM)	Lee Metcalf National Wildlife Refuge (USFWS)
Anaconda Pintler Wilderness Area (USFS)	Fort Union Trading Post Nat'l Historic Site (NPS)	Lost Trail National Wildlife Refuge (USFWS)
Bob Marshall Wilderness Area (USFS)	Grant-Kohrs Ranch Nat'l Historic Site (NPS)	Black Coulee National Wildlife Refuge (USFWS)
Bear Trap Canyon Wilderness Area (BLM)	Nez Perce National Historic Park (NPS)	Medicine Lake National Wildlife Refuge (USFWS)
Cabinet Mountains Wilderness Area (USFS)	Big Horn Canyon National Recreation Area (NPS)	Bowdoin National Wildlife Refuge (USFWS)
Gates of the Mountains Wilderness Area (USFS)	Arrow Creek BCA (BLM)	Nine-pipe National Wildlife Refuge (USFWS)
Great Bear Wilderness Area (USFS)	Crooked Creek BCA (BLM)	Charles M. Russell Nat'l Wildlife Refuge(USFWS)
Lee Metcalf Area (USFS & BLM)	Wales Backcountry Conservation Area (BLM)	Creedman Coulee Nat'l Wildlife Refuge (USFWS)
Medicine Lake Wilderness Area (USFWS)	Hoodoos Backcountry Conservation Area (BLM)	Grass Lake Nat'l Wildlife Refuge (USFWS)
Mission Mountains Wilderness Area (USFS)	Bear Trap Canyon Nat'l Recreation Trail (BLM)	Hailstone National Wildlife Refuge (USFWS)
Rattlesnake Wilderness Area (USFS)	Centennial Nat'l Recreation Trail (BLM)	Red Rock Lakes Nat'l Wildlife Refuge (USFWS)
Red Rock Lakes Park Wilderness Area (USFWS)	Continental Divide Nat'l Scenic Trail(NPS&BLM)	Swan River Nat'l Wildlife Refuge (USFWS)
Scapegoat Wilderness Area (USFS)	Garnet National Winter Trail (BLM)	Hewitt Lake Nat'l Wildlife Refuge (USFWS)
Selway Bitterroot Wilderness Area (USFS)	Pacific Northwest Nat'l Scenic Trail (NPS)	UL Bend Nat'l Wildlife Refuge (USFWS)
UL Bend Wilderness Area (USFWS)	Ice Age Floods Nat'l Geologic Trail (NPS)	Lake Mason Nat'l Wildlife Refuge (USFWS)
Welcome Creek Wilderness Area (USFS)	Lewis & Clark Nat'l Historic Trail (NPS & BLM)	War Horse Nat'l Wildlife Refuge (USFWS)
Mission Mountains Tribal Wilderness Area(CSKT)	Nez Perce Nat'l Historic Trail (NPS & BLM)	Lake Thibadeau Nat'l Wildlife Refuge (USFWS)
Yellowstone National Park (NPS)	Upper Missouri Breaks Wild & ScenicRiver(BLM)	Pablo Nat'l Wildlife Refuge (USFWS)
Glacier National Park (NPS)	Flathead Wild & Scenic River (NPS & USFS)	Lamesteer Nat'l Wildlife Refuge (USFWS)
Big Hole National Battlefield (NPS)	East Rosebud Wild & Scenic River (USFS)	Blackfoot Valley Nat'l Wildlife Refuge (USFWS)
Little Bighorn Battlefield Nat'l Monument (NPS)	National Bison Range (USFWS)	Rocky Mnt Front Nat'l Wildlife Refuge (USFWS)
Pompey's Pillar Nat'l Monument (BLM)	Benton Lake National Wildlife Refuge (USFWS)	
WILDERNESS STUDY AREAS		
Antelope Creek WSA (BLM)	East Fork Blacktail Deer Creek WSA (BLM)	Square Butte WSA (BLM)
Axolotl Lakes WSA (BLM)	Elkhorn Wilderness WSA (BLM)	Stafford WSA (BLM)
Beaver Meadows WSA (BLM)	Ervin Ridge WSA (BLM)	Terry Badlands WSA (BLM)
Bell/Limekiln Canyons WSA (BLM)	Farlin Creek WSA (BLM)	Twin Coulee WSA (BLM)
Big Horn Tack-on WSA (BLM)	Henneberry Ridge WSA (BLM)	Wales Creek WSA (BLM)
Billy Creek WSA (BLM)	Hidden Pasture Creek WSA (BLM)	Woodhawk WSA (BLM)
Bitter Creek WSA (BLM)	Hoodoo Mountain WSA (BLM)	Yellowstone River Island WSA (BLM)
Black Sage WSA (BLM)	Humbug Spires WSA (BLM)	Ten Lakes WSA (USFS)
Blacktail Mountains WSA (BLM)	Musselshell Breaks WSA (BLM)	Big Snowy Mountains WSA (USFS)
Bridge Coulee WSA (BLM)	North Fork Sun River WSA (BLM)	Blue Joint WSA (USFS)
Burnt Lodge WSA (BLM)	Pryor Mountain WSA (BLM)	Hyalite-Porcupine-Buffalo Horn WSA (USFS)
Burnt Timber Canyon WSA (BLM)	Quigg West WSA (BLM)	Middle Fork Judith River WSA (USFS)
Centennial Mountains WSA (BLM)	Ruby Mountains WSA (BLM)	Sapphires WSA (USFS)
Cow Creek WSA (BLM)	Seven Blackfoot WSA (BLM)	West Pioneers WSA (USFS)
Dog Creek South WSA (BLM)	Sleeping Giant/Sheep Creek WSA (BLM)	
AREAS of CRITICAL ENVIRONMENTAL CONCERN		
Bridger Fossil Area ACEC (BLM)	Zortman/Landusky Mine Reclamation ACEC (BLM)	Long Medicine Wheel ACEC (BLM)
Castle Butte ACEC (BLM)	Hell Creek ACEC (BLM)	Walstein ACEC (BLM)
East Pryor ACEC (BLM)	Ash Creek Divide ACEC (BLM)	Elkhorn Mountains ACEC (BLM)
Four Dances Natural Area ACEC (BLM)	Battle Butte ACEC (BLM)	Humbug Spires ACEC (BLM)
Grove Creek ACEC (BLM)	Big Sheep Mountain ACEC (BLM)	Ringing Rocks ACEC (BLM)
Meeteetse Spires ACEC (BLM)	Black-footed Ferret ACEC[1] (BLM)	Sleeping Giant ACEC (BLM)
Petroglyph Canyon ACEC (BLM)	Bug Creek ACEC (BLM)	Beaverhead Rock ACEC (BLM)
Pompey's Pillar ACEC (BLM)	Finger Butte ACEC (BLM)	Block Mountain ACEC (BLM)
Pryor Foothills RNA ACEC (BLM)	Hoe ACEC (BLM)	Blue Lake ACEC (BLM)
Stark Site ACEC (BLM)	Howrey Island ACEC[1] (BLM)	Centennial Mountains ACEC (BLM)
Weatherman Draw ACEC (BLM)	Jordan Bison Kill ACEC (BLM)	Centennial Sandhills ACEC (BLM)
Kevin Rim ACEC (BLM)	Piping Plover ACEC[1] (BLM)	Everson Creek ACEC (BLM)
Sweetgrass Hills ACEC (BLM)	Powder River Depot ACEC (BLM)	Muddy Creek/Big Sheep Creek ACEC (BLM)
Azure Cave ACEC (BLM)	Reynolds Battlefield ACEC (BLM)	Virginia City Historic District ACEC (BLM)
Big Bend of the Milk River ACEC (BLM)	Sand Arroyo ACEC (BLM)	Phil Wright Rock ACEC (BLM)
Bitter Creek ACEC (BLM)	Seline ACEC (BLM)	Square Butte ONA ACEC (BLM)
Mountain Plover ACEC (BLM)	Smoky Butte ACEC (BLM)	Acid Shale-Pine Forest ACEC (BLM)
Prairie Dog Towns ACEC (BLM)		Cow Creek ACEC (BLM)

Frenchman Breaks ACEC (BLM) Malta Geologic ACEC (BLM) Woody Island ACEC (BLM)	Cedar Creek Battlefield ACEC (BLM) Flat Creek ACEC (BLM) Powderville ACEC (BLM)	Fort Meade Recreation Area ACEC (BLM) Fossil Cycad ACEC (BLM)
STATE PARKS/ WILDLIFE MANAGEMENT AREAS		
Ackley Lake State Park (MFWP) Anaconda Smelter Stack (MFWP) Bannack State Park (MFWP) Beaverhead Rock State Park (MFWP) Beavertail Hill State Park (MFWP) Big Arm State Park (MFWP) Black Sandy State Park (MFWP) Brush Lake State Park (MFWP) Chief Plenty Coups State Park (MFWP) Clarks Lookout State Park (MFWP) Cooney State Park (MFWP) Council Grove State Park (MFWP) Elkhorn State Park (MFWP) Finley Point State Park (MFWP) First Peoples Buffalo Jump (MFWP) Fish Creek State Park (MFWP) Fort Owen State Park (MFWP) Frenchtown Pond State Park (MFWP) Giant Springs State Park (MFWP) Granite State Park (MFWP) Greycliff Prairie Dog Town State Park (MFWP) Hell Creek State Park (MFWP) Lake Elmo State Park (MFWP) Lake Mary Ronan State Park (MFWP) Les Mason State Park (MFWP) Lewis & Clark Caverns State Park (MFWP) Logan State Park (MFWP) Lone Pine State Park (MFWP) Lost Creek State Park (MFWP) Madison Buffalo Jump State Park (MFWP) Makoshika State Park (MFWP) Medicine Rocks State Park (MFWP) Milltown State Park (MFWP) Missouri Headwaters State Park (MFWP) Painted Rocks State Park (MFWP) Pictograph Cave State Park (MFWP) Pirogue Island State Park (MFWP) Placid Lake State Park (MFWP) Rosebud Battlefield State Park (MFWP) Salmon Lake State Park (MFWP)	Sluice Boxes State Park (MFWP) Smith River State Park (MFWP) Spring Meadow Lake State Park (MFWP) Thompson Falls State Park (MFWP) Tongue River Reservoir State Park (MFWP) Tower Rock State Park (MFWP) Travelers' Rest State Park (MFWP) Wayfarers State Park (MFWP) West Shore State Park (MFWP) Whitefish Lake State Park (MFWP) Wild Horse Island State Park (MFWP) Yellow Bay State Park (MFWP) Amelia Island WMA (MFWP) Aunt Molly WMA (MFWP) Bear Creek WMA (MFWP) Beartooth WMA (MFWP) Beckman WMA (MFWP) Big Lake WMA (MFWP) Bighorn Viewing Site WMA (MFWP) Blackfoot-Clearwater WMA (MFWP) Blackleaf WMA (MFWP) Blacktail WMA (MFWP) Blue Eyed Nellie WMA (MFWP) Bull River WMA (MFWP) Calf Creek WMA (MFWP) Canyon Creek WMA (MFWP) Canyon Ferry WMA (MFWP) Cree Crossing WMA (MFWP) Dodson Creek WMA (MFWP) Dodson Dam WMA (MFWP) Dome Mountain WMA (MFWP) Ear Mountain WMA (MFWP) Elk Island WMA (MFWP) Fish Creek WMA (MFWP) Fleecer Mountain WMA (MFWP) Fox Lake WMA (MFWP) Freezout Lake WMA (MFWP) Fresno Reservoir WMA (MFWP) Fresno Tailwater WMA (MFWP) Full Curl WMA (MFWP)	Gallatin WMA (MFWP) Garrity Mountain WMA (MFWP) Grant Marsh WMA (MFWP) Haymaker WMA (MFWP) Hinsdale WMA (MFWP) Isaac Homestead WMA (MFWP) Judith River WMA (MFWP) Kootenai Falls WMA (MFWP) Kootenai West WMA (MFWP) Kootenai Woods WMA (MFWP) Lake Helena WMA (MFWP) Lost Creek WMA (MFWP) Lost River WMA (MFWP) Marias River WMA (MFWP) Marshall Creek WMA (MFWP) Mount Haggin WMA (MFWP) Mount Jumbo WMA (MFWP) Mount Silcox WMA (MFWP) Nevada Lake WMA (MFWP) Ninepipe WMA (MFWP) North Shore WMA (MFWP) Pablo WMA (MFWP) Ray Kuhns WMA (MFWP) Robb-Ledford WMA (MFWP) Rookery WMA (MFWP) Roundhorn WMA (MFWP) Seven Sisters WMA (MFWP) Silver Run WMA (MFWP) Sleeping Buffalo WMA (MFWP) Smith River WMA (MFWP) Spotted Dog WMA (MFWP) Spring Coulee WMA (MFWP) Stucky Ridge WMA (MFWP) Sun River WMA (MFWP) Threemile WMA (MFWP) Vandalia WMA (MFWP) Wall Creek WMA (MFWP) Warm Springs WMA (MFWP) Yellowstone WMA (MFWP)

PDM as conducted by WS-Montana does not have an impact on ecological, cultural, historical, geological, paleontological, or plant resources because habitat is not impacted by WS-Montana during PDM. WS-Montana PDM also does not impact amphibians, fish, or invertebrates in Montana. PDM has no potential to affect scenic qualities and has only minor potential to affect aesthetic and recreational qualities of SMAs because WS-Montana works on relatively few SMAs, and such work is limited in scope and duration, as discussed in this section. Although WS-Montana has the potential to take some species of birds and mammals during PDM, WS-Montana is not likely to impact these species under the current program (see Section 3.7). Several SMAs have been set aside for wildlife protection, especially big game wintering areas. Other protected wildlife species which are found on some of the SMAs include T&E species and sensitive species. If an SMA has been specifically designated to protect a wildlife species that could potentially be impacted by PDM, then special restrictions might be needed. In general, PDM has not been necessary in these areas, primarily because livestock are not often allowed to graze on them.

However, PDM may be conducted on such areas if the need arises, especially during a human health and safety crisis. Similar to other types of BLM and USFS SMAs discussed above, sport hunting and PDM by private individuals using firearms and trail hounds generally is not restricted in these areas. The land management agency is responsible for identifying any conflicts that PDM might have with the management of an SMA, during the interagency coordination process. For example, if the land management agency determines that an area with special management emphasis is to be closed to all access and/or the use of firearms, or to all low level flights, then those restrictions would be included in the AWP, and WS-Montana would abide by those restrictions unless provided with a special exemption.

3.11.1 Alternative 1. Proposed Action/ No Action Alternative: Continue WS-Montana IPDM Assistance

WS-Montana currently conducts very little PDM in Wilderness Areas (WAs) or Wilderness Study Areas (WSAs), and this low level is not expected to increase significantly in the future under Alternative 1. The amount of PDM activities that is expected to occur in designated wilderness areas, proposed wilderness areas, and WSAs is either none, or so minor that the effects of any of the alternatives that involve no WS-Montana lethal work would not likely be significantly different from the effects of a "No Control in Wilderness Areas" alternative. Some wilderness, proposed wilderness and WSAs in Montana have historic grazing allotments. Historically, WS-Montana has conducted PDM activities in very few SMAs. The minor amount of PDM activities that could be conducted by WS-Montana in wilderness, proposed wilderness, or WSAs conforms to legislative guidelines, and MOUs between APHIS-WS and the responsible land management agencies.

WS-Montana and the land management agency coordinate annually to review and update AWPs which delineate what, when, why, where, and how PDM would be conducted. In WSAs and WAs, APHIS-WS uses the minimum lethal management necessary when conducting PDM activities per BLM and USFS policy. Also, to the extent possible, the control of predators causing livestock loss is limited to the individual(s) causing the damage (corrective rather than preventive actions).

Such control activities meet the non-impairment standard for wilderness characteristics, as they are temporary and do not create new surface disturbance, and therefore do not adversely affect wilderness characteristics. Also, Congressional legislation for designation of each WA specifically addresses restricted and allowable actions. Some USFS and BLM land management plans also address PDM on lands under their jurisdiction, as appropriate.

3.11.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage.

However, in the absence of lethal assistance from WS-Montana, some people could choose to take lethal action to protect domestic animals from predation, if necessary, as many lethal actions are not prohibited to the public on the majority of Montana SMAs. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts.

Additionally, activities by private individuals are not required to, and may not, be coordinated with land management agencies, tribes, and with MFWP to minimize effects on SMAs aside from restrictions defined in Montana State laws. Therefore, other private entities may have more potential effects to cultural resources. While WS-Montana would still be available for lethal technical assistance and could advise private entities on minimizing predator damage, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 2, there are likely to more impacts to Special Management Areas as compared to Alternative 1.

3.11.3 Alternative 3. WS-Montana Provides Non-Lethal IPDM Assistance Before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. WS-Montana would continue to implement IPDM actions while minimizing impacts to cultural values as described under Alternative 1. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because even if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would be likely to continue to conduct IPDM activities as described in Section 3.4.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. During (or instead of) WS-Montana's non-lethal assistance, resource owners could still choose to address the problem themselves. If resource owners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods. Resource owners could use trained and experienced WCOs or may implement lethal methods themselves. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally, without coordination of land management agencies. Therefore, other private entities may have more impacts to SMAs. While WS-Montana would still be available for lethal technical assistance and could advise private entities on measures to reduce predator damage, these efforts would not compensate for an individual's lack of experience and proficiency.

Therefore, under Alternative 3, there are likely to be more impacts to Special Management Areas as compared to Alternative 1.

3.11.4 WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species.

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. WS-Montana would continue to implement IPDM actions while minimizing impacts to SMAs as described under Alternative 1. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, in the absence of lethal assistance from WS-Montana for non-T&E species protection requests, some people could choose to take lethal action to protect domestic animals from predation, if necessary. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts. Additionally, activities by private individuals are not required to, and may not, be coordinated with other land management agencies, tribes, and with MFWP to minimize effects on SMAs aside from restrictions defined in Montana State laws. Therefore, other private entities may have more potential effects on SMAs. While WS-Montana would still be available for lethal technical assistance and could advise private entities on measures to reduce predator damage, these efforts would not compensate for an individual's lack of experience and proficiency.

Therefore, under Alternative 4, there are likely to be more impacts to Special Management Areas as compared to Alternative 1.

3.11.5 Alternative 5. No WS-Montana IPDM Activities

Under this alternative, WS-Montana would not be available to provide any IPDM activities. Resource owners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts. Additionally, activities by private individuals are not required to, and may not, be coordinated with other land management agencies, tribes, and with MFWP to minimize effects on SMAs aside from restrictions defined in Montana State laws.

Therefore, under Alternative 5, there are likely to more impacts to Special Management Areas as compared to Alternative 1-4.

3.12 How Might WS-Montana IPDM Activities effect Cultural Uses of Wildlife?

Cultural use of natural resources includes a variety of ways to recreate and or interact with the environment, including recreation, aesthetic, and spiritual connections or uses. Recreation encompasses a wide variety of outdoor entertainment in the form of consumptive and non-consumptive uses. Consumptive uses of public lands include, but are not limited to, hunting, fishing, gathering, and rock-hounding. Non-consumptive uses include activities of directly or indirectly (spiritually or emotionally) connecting with or enjoying natural resources such as bird watching, photography, camping, hiking, biking, rock climbing, winter sports and water sports. Participants for these activities include Tribal members, the general public, and their pets, which includes hunting dogs. Aesthetics is the philosophy dealing with the nature of beauty or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful.

Wildlife populations provide a range of direct and indirect social and economic benefits. Direct benefits are derived from a user's personal relationship or direct contact with wildlife and may include both consumptive (e.g. hunting), or non-consumptive (e.g., observing or photographing wildlife). Indirect benefits, or indirect exercised values, arise without a human being in direct contact with an animal and are derived from experiences such as looking at pictures or videos of wildlife, reading about wildlife or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). According to the authors, two forms of indirect benefits exist; bequest and pure existence. Bequest benefits arise from the belief that wildlife should exist for future generations to enjoy, and pure existence benefits accrue from the knowledge that the animals exist in the human environment (Decker and Goff 1987) or that they contribute to the stability of natural ecosystems (e.g. ecological, existence, bequest values; (Bishop 1987)).

Wildlife generally is regarded as providing economic, recreational and aesthetic benefits (Decker and Goff 1987) and the mere knowledge that wildlife exists is a positive benefit to many people. In a survey conducted in 2016 by U.S. Census Bureau in collaboration with the USFWS and the Association of Fish and Wildlife Agencies (U.S. Fish and Wildlife Service and U.S. Census Bureau 2016) 103.7 million Americans (40% of the U.S. population) enjoyed an outdoor recreation experience including hunting, fishing, other wildlife-associated recreation. Expenditures for 2016 for wildlife-recreation (hunting, fishing, wildlife viewing) were $156.9 billion. The 2016 Census Bureau report did not include state level data, however, the Mountain Division, which includes Montana, reported that wildlife-based recreation of hunting, fishing, and wildlife viewing included nearly 9.9 million persons (over 16 years of age); expenditures were not listed by Division. This survey does not include all forms of wildlife related recreation expenses and or types of individuals who recreate or appreciate wildlife. These expenditures occurred with the current IPDM activities in place. There may be some concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners or neighboring residents.

Public opinion about the best ways to reduce conflicts between humans and wildlife is highly variable, making the implementation of damage management actions extremely complex. Ideas about how these actions are implemented and conducted are as unique as the almost infinite combinations of philosophies, psyches, aesthetic values, personal attitudes and opinions found in humans. These differences in opinion result in concerns that the proposed action or the alternatives would result in the loss of aesthetic, recreational, spiritual, or otherwise referred to as cultural benefits to the general public, tribes, and resource owners.

3.12.1 What are the Potential Impacts of WS-Montana IPDM Activities Reducing Wildlife Interactions?

Some individuals may believe their recreational experiences on public lands are impaired by knowing that any lethal IPDM actions are occurring on these lands. Others feel that they are being deprived of the aesthetic experience of viewing or hearing coyotes or other predators because of WS-Montana IPDM actions. Occasionally, individuals may have formed an attachment to a specific coyote pack or individual animal. Removal of these packs or animals can be a cause of distress and sorrow for these individuals.

Some commenters have stated that witnessing aerial hunting activities or encountering APHIS-WS warning signs for IPDM devices or animals captured in traps is distressing and has a profound negative impact on their aesthetic and recreational enjoyment of a site. Some individuals may be reluctant to use areas or walk pets in areas where signs are posted. Disturbance (noise) associated with aerial hunting activities has also been reported as adversely impacting some individuals' recreation.

Potential for adverse impacts on recreation is not limited to use of lethal methods. The flashing lights and sounds associated with frightening devices have the potential to adversely impact individuals' outdoor experiences, especially given that these devices are deployed at night when individuals may desire to sleep or enjoy the quiet night sounds of a natural setting. Safety concerns have also been expressed regarding the use of livestock guarding dogs. Livestock guarding dogs may approach people who come near their flocks which, given the large size of the dogs, can be alarming for some people. In rare instances, livestock guarding dogs may perceive recreationists as a threat and behave aggressively, or they may prey on wildlife, or exclude wildlife species other than undesirable predators, from the area near the sheep (Timm and Schmidtz 1989, Frank 2011).

Opinions regarding the impact of IPDM on recreation and aesthetic values vary among individuals. An adverse impact associated with IPDM actions, such as the use of foothold traps, may be perceived by one individual in one way and may be perceived completely differently by an individual who hunts and traps recreationally. Some individuals believe that IPDM is acceptable because it can help bolster certain species populations such as game species (e.g. elk or mule deer) or sensitive/T/E species.

3.12.2 What are the Potential Impacts to Native American Concerns and Values?

Native American tribes have a unique cultural and spiritual relationship with wildlife and native ecosystems. The exact nature of this relationship varies among tribes, groups and families within tribes and among individuals. Native American tribes in Montana use natural resources for food, income and cultural practices. Tribal members may also derive income from providing guide services. Actions which substantively impact wildlife species population density and distribution have the potential to adversely affect tribal members spiritually, culturally and economically. Tribal members may also be concerned that predator removal could result in impacts causing trophic cascades that impact other species and plants valued by tribal members.

3.12.3 What are the Comparative Impacts of the Alternatives on Cultural Impacts?

3.12.3.1 Alternative 1. Proposed Action/No Action Alternative: Continue WS-Montana IPDM Assistance

WS-Montana IPDM activities occur on a relatively limited portion of the lands in Montana (Section 1.11.2.9) and the proportion of individual predators removed through IPDM activities is small in comparison to their population (Section 3.5). Furthermore, WS-Montana actively works on only a small portion of all the available properties it is authorized to work at any given time. Of those properties being actively worked, IPDM activities are conducted on only a fraction of the total area which the property encompasses. In localized areas where WS-Montana does remove some portion of the local predator population, dispersal of predators from adjacent areas typically contributes to repopulation of the area within a few weeks to a year, depending on the level of predator removal and predator population levels in nearby areas (Gese 2005). Most of the species potentially affected by WS-Montana IPDM activities are relatively abundant, but are not commonly observed because of their secretive and largely nocturnal behavior. The likelihood of getting to see or hear a predator in some localized areas could be temporarily reduced as a result of WS-Montana IPDM activities, but because there is already a low likelihood of seeing a predator, this temporary local reduction in public viewing opportunity would not likely be noticeable in most cases. Additionally, many of the species which could be targeted in this EA may also be taken by hunters and trappers and WS-Montana take is a small fraction of those taken by other harvest methods (Section 3.5). Consequently, for most species, the presence or absence of impacts of WS-Montana IPDM activities may not be discernable from impacts from other sources. Overall impacts on predator populations would be relatively low, and opportunities to view, hear or see evidence of predators would still remain. The potential minor reduction in local opportunity to view predators must be considered with all potential impacts, including the potential economic and emotional harm suffered by resource owners or others affected by predator damage, if management activities were not implemented.

Game and non-game wildlife populations are not significantly impacted by WS-Montana's IPDM activities (Section 3.7 and 3.8) on public or private lands, allowing hunters ample opportunities for pursuit. Recreationists interested in viewing and photography opportunities for wildlife also have ample areas in Montana that are suitable for seeing abundant wildlife. WS-Montana activities do not significantly impact animal populations and it does not remove a significant number of any one species. In fact, WS-Montana activities could bolster local populations of wildlife and increase opportunities for cultural uses by implementing IPDM activities for the protection of wildlife species, or indirectly when implemented for the protection of other resources.

Procedures and policies designed to minimize WS-Montana impacts on recreation are in place. As discussed in Chapter 1 (Section 1.9.4), 83% of the conflicts WS responds to occur on private lands. On private lands, the cooperators or landowners are aware that IPDM control tools are set and can alert visitors using the property of their presence. Landowners determine the areas and timing of equipment placement, thereby avoiding conflicts with recreationists. WS-Montana personnel post signs in prominent places to alert the public (on both private and public lands) that IPDM tools are set in an area.

On public lands, WS-Montana coordinates with the public land management agencies through AWPs or other means and designates different work zones on maps to reduce potential problems. For example, public safety zones are designated on maps associated with the AWP and WS-Montana does not set equipment within a ¼ mile of these areas. WS-Montana does not conduct IPDM in high use recreational areas except for the purposes of human health and safety protection and only after receiving a request from the applicable public land management official. High use recreation and other sensitive areas are identified at a site-specific level in WS-Montana AWPs on maps or as new damage situations arise. Public safety zones, planned control areas, and restricted or coordinated control areas are identified through interagency coordination.

Similarly, WS-Montana does not anticipate conducting IPDM in National Parks. However, the potential exists that a request could come from the National Park Service, USFWS, MFWP, or other agencies regarding a threat to human health and safety or for research purposes. Methods with low, short-term highly controlled impacts (e.g., calling and shooting) may be given preference over methods which would require a prolonged WS-Montana presence in the area (e.g., foothold traps and snares).

To the extent practicable, when IPDM actions are necessary near areas with public use, WS-Montana strives to schedule activities at times and in seasons when recreational activity is likely to be low. These areas are designated in AWPs and on maps so IPDM does not unnecessarily interfere with recreational activities. Other strategies used by WS-Montana to reduce risk that IPDM activities would adversely impact an individual's recreational experience include setting capture devices well away from roads and trails.

Conflicts with recreationists are further reduced due to the inherent nature of IPDM. WS-Montana conducts most IPDM on public lands for grazing allotments with sheep and cattle. Regarding livestock protection and natural resource protection, these areas are generally not used extensively by recreationists during the spring and early summer months when WS-Montana would be more likely to conduct IPDM. Most recreational areas are set aside or designated for recreation and grazing is not allowed. The highest seasonal IPDM activity for the protection of livestock coincides with lambing and calving, which is normally in the spring. During this time, aerial shooting is normally the method of choice because many of the grazing areas have poor access and driving conditions are usually limited by wet grounds. Many recreationists as well as WS-Montana employees may have limited access to these public lands because of these limitations. In addition, WS-Montana currently averages only 3.41 and 0.58 minutes of flight time per square mile annually, on public lands and tribal lands, respectively (Management Information System 2016). Most recreationists are totally unaware of the PDM actions and the quality of the outdoor experience is not disrupted. Thus, WS-Montana avoids significant effects on recreational users.

Some groups or individuals have expressed concerns regarding the effects of WS-Montana's low-level flights on non-target wildlife and on public land recreational users (Section 3.10.1.3). WS-Montana conducts IPDM activities on a fraction of all potential land that is authorized under agreement or WID. WS-Montana concentrates flying efforts during certain times of the year to specific areas, such as lambing grounds, so the amount of time spent flying over properties under agreement is relatively small on an annual basis. The average flight time for WS-Montana for all land classes for FY13-17 is 3.88 minutes per mi^2 annually. Thus, the average amount of time during any given year that WS-Montana spends on a given property is minimal. Additionally, as the majority of low-level flying in Montana is typically conducted in remote spring lambing and calving grounds, it is unlikely that recreationists would find themselves in a situation to be disturbed. MDOL issued 36 permits in 2019 for aerial shooting by private individuals for take of coyotes or red fox (MDOL 2020, unpublished data). Some disruption associated with aircraft use may be attributable to non-WS entities.

In some instances, use of aircraft may have less of an impact on recreation and aesthetic values than some other methods despite any potential noise and visual effects. As noted above, the actual time spent flying in a specific area, especially on public land, was very low. Wagner and Conover (1999) determined that winter proactive aerial hunting resulted in less use of traps snares and M-44s for corrective control during summer months. In situations where there are concerns regarding interactions with summer recreational activities, a brief period of aerial hunting (minutes) may have less impact than more prolonged use of methods such as traps and snares (days).

Nonlethal control methods approved for use on most USFS, BLM and other lands include: mechanical and non-mechanical scare devices; livestock guarding animals; husbandry practices; herding dogs; and chemical and visual repellents. APHIS-WS is working collaboratively with livestock producers and land managers on ways to reduce interactions between livestock and recreationists and on the production and dissemination of educational materials and informative signs on livestock protection dogs (Marlow 2016). Lethal control methods approved for use on most USFS and BLM lands includes: foothold, cage, culvert and humane-kill traps; neck and foot snares; calling/shooting; decoy dogs; aerial gunning (fixed-wing and helicopter); and, EPA and MDA registered predacides (gas cartridges for denning and M-44s). Prior to application of predacides or chemical repellents, WS-Montana will ensure compliance with the National Pollution

Discharge Elimination System. For each Forest, BLM District District/Area, there may be specific restrictions to the use of individual control methods regarding when, where and how they may be used. The AWP developed for each public lands Forest or District/Area spells out these restrictions.

WS-Montana recognizes that some actions such as the disturbance associated with lethal removal and non-lethal hazing of wildlife, may cause temporary localized shifts in species presence and or distribution, which could impact tribal members. Predicting impacts and establishing ways to meet agency objectives on tribal members and tribal spiritual practices is complicated by the private nature of some tribal religious practices. In general, based on analysis of impacts on target and non-target species populations, recreation and aesthetics, these impacts are expected to be low. Nonetheless, WS-Montana recognizes that the agency has unique government-to-government obligations to the tribes as established in treaties. Native American tribes may choose to work with relevant cooperating agencies for meeting PDM needs, request assistance from WS-Montana, hire commercial control companies, or conduct their own work. Any participating Tribes would need to make their own decision regarding the management alternatives they choose to implement. WS-Montana respects the rights of sovereign tribal governments, provides early opportunities for all federally recognized tribes in Montana to participate in planning and developing PDM strategies affecting tribal interests through consultations, cooperating agency status, and government-to-government relationships consistent with USDA APHIS Directive 1040.3 and federal policy. Practices to help reduce risks of adverse impacts on tribal members are listed in Section 2.4.

Depending on the activity, potential impacts from IPDM on cultural values could include increased or decreased quality of interactions with wildlife for future consumptive and non-consumptive uses. As described in Section 3.5 to 3.11, WS-Montana has low or negligible impacts on predator species populations, T&E species populations, species taken unintentionally, trophic cascades, humaneness, the environment, humans, or domestic animals, and SMAs from its IPDM activities. Due to the low or negligible impacts described, and the protective measures described in Section 2.4, WS-Montana would have minimal effects on Cultural uses of wildlife resources.

3.12.3.2 Alternative 2. WS-Montana Provides Lethal and Non-lethal IPDM Technical Assistance and Only Non-lethal Preventive and Corrective Operational Assistance

Under this alternative, WS-Montana would provide non-lethal and lethal technical assistance, and non-lethal operational assistance only. Other commercial, governmental, and private entities and landowners will continue to conduct IPDM activities as described in Section 3.4.

With this alternative, WS-Montana would use the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) for providing advice and technical assistance, as well as training on identification of species, and possibly individual animals, causing damage. WS-Montana would take into consideration cultural values as described under Alternative 1.

However, in the absence of lethal assistance from WS-Montana, some people could choose to take lethal action to protect domestic animals from predation, if necessary. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts. Additionally, activities by private individuals are not required to and may not be coordinated with other land management agencies, tribes, and with MFWP to minimize exposure to the public viewing or recreational activities aside from restriction define in Montana State laws. Therefore, other private entities may have more potential effects to cultural resources. While WS-Montana would still be available for lethal technical assistance and could advise private entities on minimizing cultural impacts, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 2, there are likely to more impacts to consumptive, non-consumptive uses, aesthetics, and Native American cultural uses as compared to Alternative 1.

3.12.3.3 Alternative 3. WS-Montana Provides Non-lethal IPDM Assistance before Recommending or Applying Lethal Assistance

Under Alternative 3, WS-Montana would provide technical assistance for both lethal and non-lethal activities, but the cooperator would need to apply reasonable non-lethal methods before WS-Montana would provide lethal assistance. WS-Montana would continue to implement IPDM actions while minimizing impacts to cultural values as described under Alternative 1. The APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b) may not be fully effective because even if they are deemed necessary, lethal actions could not be used by WS-Montana during the time that non-lethal methods are attempted to address the immediate problems. Other commercial, governmental, and private entities and landowners would be likely to continue to conduct IPDM activities as described in Section 3.4.

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. During (or instead of) WS-Montana's non-lethal assistance, landowners could still choose to address the problem themselves. If landowners determined that lethal IPDM is immediately necessary, they may implement lethal methods before applying all reasonable non-lethal methods.

Landowners could use trained and experienced WCOs or may implement lethal methods themselves. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally, without coordination of land management agencies and tribes, or more accessible to the public. Therefore, other private entities may have more protection impacts to cultural resources. While WS-Montana would still be available for lethal technical assistance and could advise private entities on measures to reduce cultural impacts, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 3, there are likely to be more impacts to consumptive, non-consumptive uses, aesthetics, and Native American cultural uses as compared to Alternative 1.

3.12.3.4 Alternative 4. WS-Montana Provides IPDM Lethal Assistance Only for Cases of Human/Pet Health or Safety and/or to Eradicate Invasive Feral Swine and/or to Protect Threatened or Endangered Species

Under Alternative 4, WS-Montana would provide full IPDM technical and operational assistance (Appendix A), but lethal control could only be included as an option when responding to requests to protect human/pet health or safety, to protect federally-listed T&E species, or to eradicate invasive feral swine. WS-Montana could not use lethal methods as part of IPDM to respond to other types of requests (e.g., agriculture, property, and game species). For threats to human and pet health or safety, the primary predator species of concern would be bears, mountain lions, wolves, or coyotes in residential areas, or disease vector species. Any predator species have the potential to be threats to T&E species. Feral swine have not yet been confirmed in Montana, but in the event of their discovery in the state, lethal control would be implemented to prevent the establishment of a permanent population. WS-Montana would continue to implement IPDM actions while minimizing impacts to cultural values as described under Alternative 1. Other commercial, governmental, and private entities and landowners would continue to conduct IPDM activities as described in Section 3.4. Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

However, in the absence of lethal assistance from WS-Montana for non-T&E species protection requests, some people could choose to take lethal action to protect domestic animals from predation, if necessary. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available, or attempt to address their IPDM needs themselves (as discussed in Section 3.4). Relatively few WCOs are available for large predator damage management, but landowners can request someone to work as their agent. Private individuals are not likely to have the consistent training with lethal methods, the experience to confirm the cause of damage, or the level of selectivity possessed by WS-Montana employees. WCOs may not have the experience or response capability with some of the species and methods if they are not already conducting IDPM activities for those particular species (Section 3.4.2).

There is a potential for other entities (as discussed in Section 3.4) to attempt to fill the need for lethal IPDM activities in the absence of lethal operational assistance from WS-Montana. Other entities would likely increase lethal IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana. Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts. Additionally, activities by private individuals are not required to and may not be coordinated with other land management agencies, tribes, and with MFWP to minimize exposure to the public viewing or recreational activities aside from restriction define in Montana State laws. Therefore, other private entities may have more potential effects to cultural resources. While WS-Montana would still be available for lethal technical assistance and could advise private entities on applicable BMPs, these efforts would not compensate an individual's lack of experience and proficiency.

Therefore, under Alternative 4, there are likely to be more impacts to consumptive, non-consumptive uses, aesthetics, and Native American cultural uses as compared to Alternative 1.

3.12.3.5 Alternative 5. No WS-Montana IPDM Activities

Under this alternative, WS-Montana would not be available to provide any IPDM activities. Landowners experiencing damage or threats could only depend on advice and responses from commercial WCOs, MFWP, or other entities. Entities requesting lethal assistance would have to determine if a commercial WCO or other private individual with the capabilities, approvals, and interest is available (as discussed in Section 3.4). Other entities would likely increase IPDM actions in proportion to the reduction of services that would normally be provided by WS-Montana.

Depending on the skillset of others, it is possible that more animals could be taken unintentionally by other entities, as a result of less selective and less proficient removal efforts. Additionally, activities by private individuals are not required to and may not be coordinated with other land management agencies, tribes, and with MFWP to minimize exposure to the public viewing or recreational activities aside from restriction define in Montana State laws.

Therefore, under Alternative 5, there are likely to more impacts to consumptive, non-consumptive uses, aesthetics, and Native American cultural uses as compared to Alternative 1-4.

Summary of the Environmental Effects of Each Alternative by Issue (Table 3.21)

Issues	Alternative 1 Proposed Action/No Action-Continue WS-Montana IPDM Assistance	Alternative 2 Lethal and Non-lethal IPDM Technical Assistance and Non-lethal Operational Assistance	Alternative 3 Non-lethal IPDM Assistance before Recommending or Applying Lethal IPDM Assistance	Alternative 4 Lethal IPDM Assistance Only For Protection of Human/Pet Safety, and/or T&E Species, and/or Feral Swine Eradication	Alternative 5 No WS-Montana IPDM Activities
Effects on predator species populations	Current and projected direct and cumulative take are well below maximum sustainable harvest levels as determined by a review of the available scientific literature. All predator species populations are stable as determined by MFWP. WS-Montana is not and would not adversely impact any native predator populations.	WS-Montana would have no effect on predator species populations. Other entities would be expected to fill the need for lethal operational assistance to some degree and have a level of take similar to the cumulative take under Alternative 1. Take by other sources would not be expected to near the maximum sustainable harvest levels. Predator populations would be expected to remain stable.	WS-Montana would have slightly less effects on predator species populations compared to Alternative 1. Other entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary. Cumulative levels of take would be expected to be similar to Alternative 1 and would not be expected to near the maximum sustainable harvest levels. Predator populations would be	WS-Montana would have less effects on predator species populations compared to Alternatives 1 and 3. Other entities would be expected to fill the need for lethal IPDM to protect other resources to some degree and have a level of take similar to the cumulative take under Alternative 1. Cumulative take would not be expected to near the maximum sustainable harvest levels. Predator populations would be expected to remain stable.	WS-Montana would have no effect on predator species populations. Other entities would be expected to fill the need for lethal operational assistance to some degree. Without WS-Montana technical or non-lethal operational assistance, other entities may be less efficient and effective, and therefore effects on predator species populations would likely be higher than under Alternatives 1-4. Predator populations would be expected to remain stable.

			expected to remain stable.		
Effects on threatened and endangered species	WS-Montana has had no take of T&E species since at least FY 2001 and has completed appropriate ESA consultations with USFWS to avoid jeopardy to the wolverine. WS-Montana is not likely to adversely affect any other T&E species or would have no effect. Effects are expected to continue to be minimal. WS-Montana would continue to conduct IPDM to protect T&E species.	WS-Montana would have less effects on T&E species compared to Alternative 1. T&E species would not benefit from lethal IPDM conducted by WS-Montana for T&E species protection. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in higher risks to T&E species than under Alternative 1.	WS-Montana would have slightly less effects on T&E species compared to Alternative 1. Other entities would be expected to fill the need for lethal operational assistance to some degree if lethal IPDM is deemed immediately necessary, potentially resulting in higher risks to T&E species than under Alternative 1.	WS-Montana would have less effects on T&E species compared to Alternatives 1 and 3. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in higher risks to T&E species, than under Alternative 1. WS-Montana would continue to conduct IPDM to protect T&E species.	WS-Montana would have no effect on T&E species. T&E species would not benefit from all IPDM conducted by WS-Montana for T&E species protection. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in higher risks to T&E species. Without WS-Montana technical or non-lethal operational assistance, other entities may be less efficient and effective, and therefore adverse effects on T&E species would be expected to be higher than under Alternatives 1-4.
Effects on species taken unintentionally	WS-Montana's IPDM activities lethally take very few individual animals unintentionally and activities are highly selective for specific	WS-Montana would likely take fewer individual animals unintentionally compared to Alternative 1. Other entities would be	WS-Montana would likely take slightly fewer individual animals unintentionally compared to Alternative 1. Other	WS-Montana would likely take fewer individual animals unintentionally compared to Alternatives 1 and 3. Other entities would	WS-Montana would have no unintentional take of individual animals. Other entities would be expected to fill the need for lethal operational assistance

	predator species. WS-Montana's unintentional take is expected to remain negligible.	expected to fill the need for lethal operational assistance to some degree and potentially have a higher level of take compared to Alternative 1.	entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary, potentially resulting in higher unintentional take compared to Alternative 1.	be expected to fill the need for lethal operational assistance to some degree and potentially have a higher level of take compared to Alternative 1.	to some degree, potentially resulting in higher unintentional take. Without WS-Montana technical or non-lethal operational assistance, other entities may be less efficient and effective, and therefore effects on species taken unintentionally would be expected to be higher than under Alternatives 1-4.
Effects on ecological trophic cascades	The effects of WS-Montana IPDM activities on predator species populations are temporary, localized, and of low magnitude. It is highly unlikely that WS- Montana's current and projected direct and cumulative take will contribute to any trophic cascades.	WS-Montana would have no take. Other entities would be expected to fill the need for lethal operational assistance to some degree and potentially have a higher level of take compared to Alternative 1. However, it is highly unlikely that take by other entities will contribute to any trophic cascades.	WS-Montana would have slightly less take compared to Alternative 1. Other entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary. Cumulative levels of take would be expected to be similar to Alternative 1. It is highly unlikely that cumulative take will contribute to any trophic cascades.	WS-Montana would have less take compared to Alternatives 1 and 3. Other entities would be expected to fill the need for lethal operational assistance to some degree and potentially have a higher level of take compared to Alternative 1. It is highly unlikely that cumulative take will contribute to any trophic cascades.	WS-Montana would have no take. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in a higher level of take. Without WS-Montana technical or non-lethal operational assistance, other entities may be less efficient and effective, and therefore take would be expected to be higher than under Alternatives 1-4. However, it is highly unlikely that take by

					other entities will contribute to any trophic cascades.
Effects on humaneness and ethics	WS-Montana follows APHIS-WS training, Directives, and ethics policies. WS-Montana also follows state laws and regulations and utilizes BMPs, expertise, and highly selective methods to uphold high standards of humaneness and ethics.	WS-Montana would continue to uphold the same standards under Alternative 1. In addition, some people may feel it is unethical and inhumane not to take lethal measures to protect domestic animals from predation, if necessary. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, technical assistance would not compensate for private entities lack of experience in lethal IPDM, likely resulting in less humane and ethical practices compared to Alternative 1.	WS-Montana would continue to uphold standards under Alternative 1. However, in cases where lethal IPDM is deemed immediately necessary, it may be less humane and ethical to delay immediate lethal action. Other entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary, potentially resulting in less humane and ethical practices as compared to Alternative 1.	WS-Montana would continue to uphold standards under Alternative 1. In addition, some people may feel it is unethical and inhumane not to take lethal measures to protect domestic livestock from predation, if necessary. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, technical assistance would not compensate for private entities lack of experience in lethal IPDM, likely resulting in less humane and ethical practices compared to Alternative 1.	WS-Montana have no effect on humaneness and ethics. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in less humane and ethical practices. Without WS-Montana technical or non-lethal operational assistance, other entities may be less humane and ethical compared to Alternatives 1-4.
Effects on the environment, humans, and domestic animal health and safety	The analysis of impacts on soil, water, and terrestrial and aquatic species indicates there would be little to no effect on	WS-Montana's effects on the environment, humans, and domestic animals would be less than Alternative 1. Other entities would	WS-Montana's effects on the environment, humans, and domestic animals would be similar to Alternative 1. Other entities would	WS-Montana's effects on the environment, humans, and domestic animals would be less than Alternatives 1 and 3. Other entities	WS-Montana would have no effect on the environment, humans, and domestic animals. Other entities would be expected to fill the

from the use of mechanical/ physical methods	the environment from WS-Montana's use of mechanical/physical methods. Risks to humans and domestic animals from WS-Montana's use of mechanical/physical methods are very low on private lands and highly unlikely on public lands due to short duration and protective measures.	be expected to fill the need for lethal operational IPDM to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	would be expected to fill the need for lethal operational IPDM to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	need for lethal operational assistance to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals. Without WS-Montana technical or non-lethal operational assistance, effects on the environment, humans, and domestic animals would be expected to be higher than under Alternatives 1-4.
Effects on the environment, humans, and domestic animal health and safety from the use of lead ammunition	Impacts of lead on soils, water, plants, aquatic species, and invertebrates from WS-Montana sources of lead is negligible. Impacts of lead on birds and terrestrial mammals from WS-Montana sources are low. Risks to humans and domestic animals from WS-Montana sources of lead are very low.	WS-Montana's use of lead would have no effect on the environment, humans, and domestic animals. Other entities would be expected to fill the need for lethal operational IPDM to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	WS-Montana's effects on the environment, humans, and domestic animals would be slightly less than Alternative 1. Other entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	WS-Montana's effects on the environment, humans, and domestic animals would be less than Alternatives 1 and 3. Other entities would be expected to fill the need for lethal operational IPDM to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals compared to Alternative 1.	WS-Montana's use of lead would have no effect on the environment, humans, and domestic animals. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in greater risks to the environment, humans, and domestic animals. Without WS-Montana technical or non-lethal operational assistance, effects on the environment, humans, and domestic animals

					would be expected to be higher than under Alternatives 1-4.
Effects on the environment, humans, and domestic animal health and safety from the use of chemical methods	The analysis of impacts on soil, water, and terrestrial and aquatic species indicates there would be little to no effect on the environment from WS-Montana's use of chemical methods. Risks to humans and domestic animals from WS-Montana's use of chemical methods are very low to negligible due to protective measures.	WS-Montana's effects on the environment, humans, and domestic animals would be less than Alternative 1. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, because chemical methods are limited for other entities, the risks to the environment, humans, and domestic animals would be less than under Alternative 1.	WS-Montana's effects on the environment, humans, and domestic animals would be slightly less than Alternative 1. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, because chemical methods are limited for other entities, the risks to the environment, humans, and domestic animals would be less than under Alternative 1.	WS-Montana's effects on the environment, humans, and domestic animals would be less than Alternatives 1 and 3. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, because chemical methods are limited for other entities, the risks to the environment, humans, and domestic animals would be less than under Alternative 1.	WS-Montana would have no effect on the environment, humans, and domestic animals. Other entities would be expected to fill the need for lethal operational assistance to some degree. However, because chemical methods are limited for other entities, the risks to the environment, humans, and domestic animals would be less than under Alternative 1.
Effects on Special Management Areas (SMAs)	WS-Montana would respond to IPDM requests by land management agencies, state agencies, or livestock permittees on SMAs. WS-Montana's response would be according to close coordination with the land management agency, MOUs, and applicable laws, agency policies,	WS-Montana's effects on SMAs would be less than Alternative 1. Other entities are expected to fill the need for lethal IPDM to some degree through other legal methods, as authorized by state agencies in coordination with land management agencies. Effects on SMAs from state and other federal	WS-Montana's effects on SMAs would be slightly less than Alternative 1. Other entities would be expected to fill the need for lethal operational assistance to some degree, as authorized by state agencies in coordination with land management agencies, if they determine that	WS-Montana's effects on SMAs would be slightly less than Alternatives 1 and 3. Other entities are expected to fill the need for lethal IPDM to some degree through other legal methods, as authorized by state agencies in coordination with land management agencies. Effects on SMAs from	WS-Montana would have no effect on SMAs. Other entities are expected to fill the need for lethal IPDM to some degree through other legal methods, as authorized by state agencies in coordination with land management agencies. Effects on SMAs from state and other federal agency IPDM

	work plans, and, as applicable, minimum requirements analyses. Current activities are infrequently requested and short duration in SMAs. WS-Montana has negligible effects to SMAs.	agency IPDM activities would be similar to Alternative 1. Effects on SMAs from other private entities would be expected to be higher than under Alternative 1.	lethal IPDM is immediately necessary. Effects on SMAs from state and other federal agency IPDM activities would be similar to Alternative 1. Effects on SMAs from other private entities would be expected to be higher than under Alternative 1.	state and other federal agency IPDM activities would be similar to Alternative 1, although may be fewer in number. Effects on SMAs from other private entities would be expected to be higher than under Alternative 1.	activities would be similar to Alternative 1. Without WS-Montana technical or non-lethal operational assistance, effects on SMAs from other private entities would be expected to be higher than under Alternatives 1-4.

Effects on Cultural Uses	WS-Montana follows APHIS-WS training, Directives, and ethics policies. WS-Montana also follows state laws and regulations and coordinates with land and wildlife management agencies, and tribes, to coordinate IPDM activities in ways to minimize impacts to recreation, aesthetics, and other cultural uses of wildlife resources.	WS-Montana would continue to uphold the same standards under Alternative 1. In addition, some people may feel it is unethical not to take lethal measures to protect domestic animals from predation, if necessary. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, technical assistance would not compensate for private entities lack of experience in lethal IPDM and coordination with tribal and other public entities, likely resulting in more cultural impacts as compared to Alternative 1.	WS-Montana would continue to uphold standards under Alternative 1. However, in cases where lethal IPDM is deemed immediately necessary, it may be less ethical to delay immediate lethal action. Other entities would be expected to fill the need for lethal operational assistance to some degree, if they determine that lethal IPDM is immediately necessary, potentially resulting in less coordination with tribal and other public entities, likely resulting in more cultural impacts as compared to Alternative 1.	WS-Montana would continue to uphold standards under Alternative 1. In addition, some people may feel it is unethical not to take lethal measures to protect domestic livestock from predation, if necessary. Other entities would be expected to fill the need for lethal operational IPDM to some degree. However, technical assistance would not compensate for private entities lack of experience in lethal IPDM, and coordination with tribal and other public entities, likely resulting in more cultural impacts as compared to Alternative 1.	WS-Montana would have no effect on cultural uses. Other entities would be expected to fill the need for lethal operational assistance to some degree, potentially resulting in less coordination with tribal and other public entities. Without WS-Montana's technical or direct assistance, the actions of other entities or persons would likely result in more cultural impacts as compared to Alternative 1-4.

3.13 How does this EA Address WS-Montana's Stated Goal and Objectives?

Section 1.5.2.1.2 states the goals and objectives of WS-Montana IPDM activities. This section identifies where the details in meeting the goals and objectives are addressed in the EA and how the alternatives compare in meeting the objectives. This section is not an environmental impact analysis. The vast majority of issues analyzed had little difference in impact among the alternatives because the Proposed and Current Action, Alternative 1, had very low impacts, however there was more variation among alternatives in meeting the objectives. Based on the information and analysis in each section, WS-Montana IPDM activities meet the goal and objectives.

Goal: Meet the APHIS-WS mission of professionally supporting the coexistence of humans and wildlife

The following components of this goal are addressed throughout this EA. WS-Montana staff consistently responds to all requests for assistance to meet the following components of the goal:

- Respond in a timely and appropriate way to all requests for assistance.
- Responses, whether over the phone, remotely, or in the field, follow a formal decision process (Slate et al. 1992, USDA Wildlife Services 2014b) to evaluate, formulate, and implement or recommend the most effective strategy.
- The recommended strategy for each response intends to effectively reduce or eliminate damage and risks caused by the offending animal(s) to resolve conflicts with humans and their valued resources, health, and safety.
- These strategies may be both short-term and/or long-term and are often a combination of lethal and/or non-lethal methodologies to ensure effectiveness.

Objectives:

Each objective listed below (Section 1.5.2) is addressed in the following sections of the EA:

1. Professionally and proficiently respond to all reported and verified losses or threats due to predators, using the IPDM approach using the APHIS-WS Decision Model (Slate et al. 1992, USDA Wildlife Services 2014b). IPDM must be consistent with all applicable federal, state and local laws, APHIS-WS policies and directives, cooperative agreements, MOUs and other requirements as provided in any decision resulting from this EA.

    - **Section 1.8:** Description of how WS-Montana works with MFWP, MLLB, MDOL, and counties, including cooperative agreements
    - **Section 1.8.2:** MOUs between APHIS-WS and USFS, USFWS, and BLM
    - **Section 1.8.1.A:** MFWP management plan for grizzly bears, gray wolves, black bear, and mountain lion
    - **Section 2.3.1.2:** Description of APHIS-WS Decision Model

- **Section 2.4:** Relevant APHIS-WS directives and policies and relevant MFWP laws and regulations for integrated predator damage management
- **Section 2.4:** Use of relevant APHIS-WS directives and relevant MFWP laws and regulations in integrated predator damage management

2. Implement IPDM so that cumulative effects do not negatively affect the viability of any native predator populations.

- **Section 3.5:** Cumulative effects analysis for native predator populations for predators taken intentionally
- **Section 3.7:** Cumulative effects analysis for native predator populations for predators taken unintentionally
- **Section 3.6:** Cumulative effects analysis for native predator populations for ESA-listed predator species
- **Section 3.8:** Cumulative impact analysis for native predator populations related to the potential to cause trophic cascades

3. Ensure that actions conducted within the IPDM strategy fall within the management goals and objectives of applicable wildlife damage management plans or guidance as determined by the jurisdictional state, tribal, or federal wildlife management agency.

- **Section 1.8.1.A:** MFWP management goals and plan for management of grizzly bears, gray wolves, black bear, and mountain lion
- **Section 3.11:** MFWP, USFS, and BLM objectives and management of predator damage in special management areas, including wilderness areas and wilderness study areas
- **Section 3.5:** Intentional take of predators either under MFWP authorization or reported to MFWP per state law and regulations

4. Minimize impacts on target and non-target species populations by using the APHIS-WS Decision Model (Slate et al. 1992, WS Directive 2.201) to select the most effective, target-specific, and humane remedies available, given legal, environmental, and other constraints.

- **Section 1.12:** Effectiveness of predator damage management
- **Section 2.3.1.2:** Description of APHIS-WS Decision Model
- **Section 2.4:** Relevant APHIS-WS directives and policies and relevant MFWP laws and regulations for predator damage management
- **Section 3.5:** Impacts of IPDM involving all known intentional and reported lethal takes of native predators
- **Section 3.6 and 3.7:** Impacts of IPDM involving all known unintentional WS-Montana take of native predators

- **Section 3.6 and 3.7:** Impacts of IPDM involving all known unintentional WS-Montana take of non-predator species during IPDM activities
- **Section 3.6:** Impacts of IPDM involving all known unintentional WS-Montana take of ESA-listed species
- **Section 3.9:** Analysis of the ethics and humaneness of IPDM methods used by WS-Montana
- **Section 3.10:** Analysis of the impacts of IPDM on the environment and risks to human health and safety

5. Incorporate the use of effective new and existing lethal and non-lethal technologies, where appropriate, into technical and direct assistance strategies.

- **Section 1.12:** Analysis of effectiveness of IPDM activities
- **Section 2.3.1 and Appendix A:** Description of WS-Montana IPDM activities, including methods
- **Section 3.9:** Analysis of the ethics and humaneness of methods used by WS-Montana for IPD

Table 3.22 Comparison of alternatives in meeting the objectives to support WS-Montana's goal to meet the APHIS-WS mission of professionally supporting the coexistence of humans and wildlife.

Alternative 1 Proposed Action/No Action-Continue WS-Montana IPDM Assistance	Alternative 2 Lethal and Non-lethal IPDM Technical Assistance and Non-lethal Operational Assistance	Alternative 3 Non-lethal IPDM Assistance before Recommending or Applying Lethal IPDM Assistance	Alternative 4 Lethal IPDM Assistance Only for Protection of Human/Pet Safety and/or T&E Species, and/or Feral Swine Eradication	Alternative 5 No WS-Montana IPDM Activities
Objective 1. Professionally and proficiently respond to all reported and verified losses or threats due to predators, using the IPDM approach using the APHIS-WS Decision Model. IPDM must be consistent with all applicable federal, state and local laws, APHIS-WS policies and directives, cooperative agreements, MOUs and other requirements as provided in any decision resulting from this EA.				
Meets all components of objective.	Meets components of objective except for proficiency and some partner agency policies and MOUs for IPDM.	Meets components of objective but may be less proficient than Alternative 1 when lethal IPDM is deemed immediately necessary.	Meets all components of objective for Human/Pet Health and Safety and T&E species protection. Does not meet components for proficiency and some partner agency policies and MOUs for IPDM for response to needs in agriculture, property and natural resource losses or threats.	Does not meet objective
Objective 2. Implement IPDM so that cumulative effects do not negatively affect the viability of any native predator populations.				
Meets objective	Meets objective	Meets objective	Meets objective	Meets objective
Objective 3. Ensure that actions conducted within the IPDM strategy fall within the management goals and objectives of applicable wildlife damage management plans or guidance as determined by the jurisdictional state, tribal, or federal wildlife management agency.				
Meets objective	Meets objective except where lethal IPDM is indicated in partner agency management	Meets objective except where non-lethal methods are inappropriate according to partner agency management	Meets objective for Human/Pet Health and Safety and T&E species protection. Meets objectives for needs to protect	Does not meet objective/not applicable.

	objectives, plans or guidance.	objectives, plans or guidance. (E.g., administrative removal of mountain lions).	agriculture, property and natural resource except where lethal IPDM is indicated in partner agency management objectives, plans or guidance.	
Objective 4. Minimize impacts on target and non-target species populations by using the APHIS-WS Decision Model to select the most effective, target-specific, and humane remedies available, given legal, environmental, and other constraints.				
Meets objective	Meets objective under the constraints of the alternative.	Meets objective under the constraints of the alternative.	Meets objective under the constraints of the alternative.	Meets objective under the constraints of the alternative.
Objective 5. Incorporate the use of effective new and existing lethal and non-lethal technologies, where appropriate, into technical and direct assistance strategies.				
Meets objective	Meets objective except for lethal technologies.	Meets objective	Meets objective for human/pet health and safety, T&E species protection, and feral swine damage management. Meets objective for agriculture, property and natural resources except for lethal technologies.	Does not meet objective

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5 Public Comments and Responses

We received 871 comment letters between January 12, 2021 and February 19, 2021. Many of these comments were identical or substantially similar. Below, we have summarized these comments. Whenever possible, we have combined similar comments together, and provided a single response which covers the breadth of those comments. All of the comments we received were either outside the scope of the EA, were adequately addressed in the Draft EA, or have been addressed more clearly in this Final EA. The vast majority of these comments were adequately addressed in the Draft EA. In the interest of transparency, we have responded to all comments, and we provide all of these comments and responses below.

Below, comments are provided in **bold**, and our response is provided below the comment in normal font (*i.e.*, not bold).

5.1 Alternatives

5.1.1 Commenters claim that the analysis of alternatives is flawed.

Some commenters stated that the EA fails to describe Alternative 1. We disagree with this assertion. The goals and objectives of WS-Montana are clearly stated in Section 1.5.2.1, The geographic scope of the EA is discussed in detail in Section 1.9.4, and the decision model used for determining PDM actions is shown in Figure 2.1 and described in Section 2.3.1.2.

Commenters claim that Alternatives 2-5 are flawed because in determining their efficacy, we assume that lethal PDM will be implemented without WS-Montana involvement. This is untrue. An explanation of what other entities could conduct PDM in the absence of WS-Montana is detailed in Section 2.3.1.9. The commenters also claim that we do not adequately analyze the effectiveness of non-lethal methods. This is also untrue. As stated in Section 1.5.2.3, 2.4.1.1, 2.5.2, 2.5.20 and throughout the document, WS-Montana gives preference to non-lethal methods where practical and effective (WS Directive 2.101). We acknowledge that non-lethal methods can be highly effective when used properly, as further detailed in Appendix A.

Commenters state that providing lethal PDM could incentivize ranchers to not take actions themselves to prevent predation, or that ranchers may allow livestock to be killed on purpose to receive lethal PDM. We disagree with the assertion that providing PDM services incentivizes ranchers to not take action. This assertion is not logical because failing to take actions to prevent predation would result in economic losses to those producers. Most producers who request WS-Montana PDM assistance have already used several non-lethal methods, as discussed in EA in Section 1.11.2.6. We also disagree with the assertion that ranchers may allow livestock to be killed on purpose to receive lethal PDM. Consideration of this topic would not be reasonable. We are not aware of any reliable information which would suggest that such a phenomenon would add substantively to the information and analyses in the EA. The cited document, Dougherty 2007, is a newspaper article, which does not contain any actionable information regarding PDM in Montana.

5.1.2 Commenters state that we improperly dismissed alternatives

Commenters state that an alternative in which only non-lethal technical assistance and non-lethal operational assistance would be conducted by WS-Montana is improperly dismissed (Section 2.5.3).

Commenters claim that we do not adequately assess the effectiveness of non-lethal methods. This assertion is false. This alternative was not considered in detail because it is sufficiently similar to Alternative 2, which is considered in detail (Section 2.3.2), not because we do not consider non-lethal methods effective.

Commenters state that an alternative in which cooperators would be required to pay 100% of the cost of lethal PDM is improperly dismissed (Section 2.5.20).

We disagree with this assertion. As stated in Section 2.5.20, this alternative would not be consistent with APHIS-WS policy. Therefore, this alternative is not considered in detail in this EA.

Commenters state that an alternative in which no PDM would be conducted by WS-Montana on federal public lands is improperly dismissed (Section 2.5.21).

We disagree with this statement. As stated in Section 2.5.21, this issue is outside the scope of APHIS-WS authority. Therefore, this alternative is not considered in detail in this EA.

Commenters state that an alternative in which WS-Montana would use only non-lead ammunition was improperly dismissed (Section 2.5.12).
We disagree with this statement. This alternative was dismissed due to limited availability of non-lead ammunition as well as the increased cost of non-lead ammunition. Commenters claim that these statements are unfounded. As stated in Section 2.5.12, WS-Montana has attempted to implement non-lead ammunition previously and found that accurate, lethal, and cost-effective non-lead ammunition is not currently available in a manner that meets program needs. Furthermore, the effects of the use of lead ammunition are discussed in detail in Section 3.10.2 of the EA, and a risk assessment for lead use in wildlife damage management (USDA Wildlife Services 2017h). WS-Montana will continue to monitor the availability and performance of non-lead ammunition and consider its use as appropriate.

5.1.3 Commenters request additional alternatives to be considered.

Commenters requested that we consider an alternative or alternatives in which one or more of the following PDM methods would be prohibited: Snares (foot and neck), leghold traps (padded and unpadded), body-crushing traps, gas cartridges, aerial gunning, and M-44s. They assert that these methods represent the cruelest and most indiscriminate methods employed by WS-Montana. We disagree with these assertions. We analyze impacts to non-target species in Section 3.7 and humaneness and ethics in Section 3.9. Because non-target take is minimal and the aforementioned methods are utilized humanely and ethically, we have determined that inclusion of these alternatives would not be reasonable for analysis.

Commenters requested that we consider an alternative in which there would be no WS-Montana PDM on public lands. A similar alternative was detailed in Section 2.5.21, which would prohibit WS-Montana from operating on federal lands. This issue is outside the scope of APHIS-WS authority. Therefore, this alternative is not considered in detail in this EA.

Commenters requested that we consider an alternative in which there would be no WS-Montana PDM on WAs and WSAs. This alternative was included in Section 2.5.22, but not considered in detail. As stated in Section 2.5.22, authorization for PDM on WAs and WSAs is determined by statutes and policies under the authority of USFS, BLM, and USFWS, not WS-Montana. Furthermore, this alternative does not meet the purpose and need established in Chapter 1. Therefore, this alternative is not considered in detail.

Commenters requested that we consider an alternative which would prohibit preventive lethal PDM. Alternative 3, detailed in Section 2.3.3, provides an alternative program with no preventive lethal PDM and a requirement that cooperators must attempt reasonable non-lethal methods prior to receiving WS-Montana assistance with lethal PDM. We believe that this alternative is not substantially different from Alternative 3 (Section 2.3.3) which is considered in detail. Therefore, this alternative is not considered in detail in this EA.

Commenters requested that we consider an alternative in which there would be no livestock grazing on public lands. This issue is outside the scope of APHIS-WS authority. Therefore, this alternative is not considered in detail in this EA.
Commenters requested that we consider an alternative which would prohibit lethal PDM of apex predators, including coyotes, mountain lions, grizzly bears, black bears, and wolves. Because the species mentioned account for approximately 95% of all WS-Montana take from FY13-FY17 (Appendix E), we believe that this Alternative is not substantially different from Alternative 2 (Section 2.3.2) which is considered in detail. Therefore, this alternative is not considered in detail in this EA.

Commenters claim that WS-Montana should prioritize nonlethal PDM, saving lethal PDM as an option only after ALL nonlethal methods have been exhausted and if the predating animal can be the only target.
Commenters requested that all non-lethal methods be used before any lethal operations can be implemented, including non-lethal methods that are not appropriate for the circumstances. As stated in Section 2.5.4, this would result in the loss of substantial time, resources, and money for both the requester and WS-Montana in implementing and monitoring all these non-lethal methods. This would potentially result in large financial losses for the requester due to livestock lost from inefficiencies in the IPDM process and/or a high risk of human/pet health or safety risks, and /or major losses to ESA-listed species. Alternatives 3 and 4 considered in detail (Sections 2.3.3 and 2.3.4) provide reasonable and viable approaches for addressing the needs of requesters and concerns of commenters without incurring unreasonable and unacceptable risks and losses. Therefore, this alternative was not considered in detail.

Commenters state that Wildlife Services should not engage in carnivore killing on public lands.
We disagree with this statement. This issue is specifically addressed in Section 2.5.21.

Commenters state that WS-Montana should never use lethal methods.
Commenters assert that WS-Montana should not kill any wildlife and instead use non-lethal methods only. Alternative 2 presented in Section 2.3.2 details a course of action in which WS-Montana would not provide lethal operational assistance. Table 3.22 shows that this alternative is not as effective at meeting the objectives stated in Section 1.5.2.1.2 as Alternative 1 and was therefore not chosen as the preferred course of action.

Commenters state that WS should be overhauled, abolished, defunded, or otherwise cease to exist.
We disagree with this statement. Wildlife Services provides valuable service to the American people by expertly resolving human-wildlife conflicts in the most practical, efficient, and humane way possible. Alternative 5 presented in Section 2.3.5 details a course of action in which WS-Montana would not be involved in any predator damage management efforts in Montana. Table 3.22 shows that this alternative is not as effective at meeting the objectives stated in Section 1.5.2.1.2 as Alternative 1 and was therefore not chosen as the preferred course of action.

A commentor claims that a predator loss tax should replace WS PDM actions.
WS is unaware of any studies that indicate it is an effective option for PDM. As stated in Section 1.13.6.2, wildlife is typically managed by the state, regardless of land ownership. There is currently no national program to equitably distribute the costs of damage by predators covered in this EA between all consumptive and non-consumptive user groups. APHIS-WS does not have the authority to establish and/or administer such as program. The decision about how to distribute the costs of wildlife management is usually considered a component of state wildlife management decisions, except for those species managed by the USFWS. This Alternative is further addressed in Section 2.5.6 but is not considered in detail because it falls outside of the authority of APHIS-WS.

Commenters believe that Alternative 3 should be modified by including a protocol for documenting cooperators' use of non-lethal methods and agency involvement in non-lethal assistance before lethal actions are taken and why methods used may or may not have worked. They claim that the amended Alternative 3 should be the preferred alternative.
Alternative 3 presented in Section 2.3.3 details a course of action in which WS-Montana would not provide lethal operational assistance until non-lethal methods had been attempted. Non-lethal and lethal technical assistance, as well as non-lethal preventive damage management, would continue to be used as described in Alternative 1.

Commenters state that adopting Alternative 3 would not create significant burdens to WS-Montana, suggest it may make the program more effective, and would better reflect public interests. Table 3.22 shows that Alternative 3 is not as effective at meeting the objectives stated in Section 1.5.2.1.2 as Alternative 1. The suggested changes would not alter the effectiveness of alternative 3 because preference is already given to non-lethal methods when practical and effective (WS Directive 2.101), therefore Alternative 1 would still be the preferred course of action.

5.2 Analysis

Commenters claim that the EA fails to adequately analyze the impacts of PDM on non-target species, and state that WS-Montana must consider the cumulative impact of killing carnivores in its analysis, including the lasting impacts to biodiversity and unintended impacts to nontarget species.
We disagree that PDM program is likely to adversely affect non-target species. Impacts on non-target species are detailed in Section 3.7. The effects of the WS-Montana PDM program on nontarget wildlife is adequately analyzed for each alternative in Section 3.7.1 of the EA. We agree that the EA must consider the cumulative impacts of PDM. Chapter 3 contains an in-depth assessment of the environmental consequences of WS-Montana's PDM actions, including unintended consequences. Our analysis determined that PDM activities conducted by WS-Montana under Alternative 1 would not result in any significant impacts to nontarget species populations, including ESA listed species (Sections 3.6.5.1 and 3.7.1.1).

Commenters claim that WS-Montana failed to analyze impacts regarding take by private hunters and trappers, and how that take would affect cumulative mortality. This is untrue. As stated in Section 3.5.1, cumulative mortality assessments in Sections 3.5.2.3.3, 3.5.3.3.3, 3.5.5.3.3, 3.5.6.3.3, 3.5.7.3.3, 3.5.8.3.3, 3.5.9.3.3, 3.5.10.3.3, and 3.5.14.3.3 utilize data from MFWP on private hunter and trapper take.

Commenters stated that we did not address demographic shifts caused by killing coyotes/compensatory reproduction. This statement is also untrue. These impacts are addressed in section 3.3.4.

Commenters also stated that we failed to address impacts beyond state lines, impacts of public land grazing, and non-PDM take by WS-Montana. All of these topics are categorically out of scope of our PDM EA and therefore were not included in our analyses.

Finally, the commenters claimed that we did not correctly calculate the projected maximum annual cumulative take of gray wolves in Table 3.6, stating "If WS-Montana will kill up to 100 wolves each year, and the highest level of cumulative take by other sources in recent years was 338, then the projected maximum annual cumulative take should be 438 (100 + 338)." This statement is false. The highest cumulative annual take in the years analyzed was 338, including WS-Montana take. Without WS-Montana take, the cumulative total would have been 267. To provide a better estimate of the maximum cumulative take annually, we used the highest annual mortality in each take category over the 5 year period (far right column, Table 3.6): hunter/furbearer harvest (255), illegal harvest (10), private citizen PDM (16), and other take (20). These numbers sum to 301. With the addition of the maximum annual take projected by WS-Montana (100 wolves) the cumulative take sums to 401, as indicated in Table 3.6.

Commenters Claim that PDM may affect threatened and endangered species protected under the Endangered Species Act of 1973 (ESA) and their critical habitats.

We disagree that PDM program is likely to adversely affect ESA listed species or their habitat. The effects of the WS-Montana PDM program on sensitive and nontarget wildlife, including ESA listed species, is adequately analyzed for each alternative in Chapter 3 of the EA. It is a false assertion that the EA contemplates violations of law, including the Endangered Species Act and the Wilderness Act. Alternative 1 would not violate any laws, including the Endangered Species Act and the Wilderness Act. Impacts on threatened and endangered species are detailed in Section 3.6. Our analysis determined that PDM activities conducted by WS-Montana would not result in any significant impacts to ESA listed species or their critical habitat (Section 3.6.5.1).

Commenters also claimed that we failed to analyze impacts to swift fox (*Vulpes velox*), long-tailed weasels (*Mustela frenata*), and short-tailed weasels (*Mustela erminea*) in Section 3.6. These species are neither state nor federally listed as threatened or endangered, and were therefore were not addressed in Section 3.6. Impacts to non-target species are addressed in Section 3.7.

Commenters claim that the EA fails to consider that predator populations are self-regulating.
WS is unaware of any data that demonstrate that self-regulation of predators meets WS objectives (*e.g*., the self-regulation of predators lowers the risk to livestock). We disagree with the claim that the EA fails to adequately consider predator behavior and family group structure in response to PDM activities (See Sections 3.5.2.1, 3.5.3.1, 3.5.4.1, 3.5.5.1, 3.5.6.1, 3.5.7.1, 3.5.8.1, 3.5.9.1, 3.5.10.1, 3.5.11.1, 3.5.12.1, 3.5.13.1, 3.5.14.1, 3.5.15.1, 3.5.2.2, 3.5.3.2, 3.5.4.2, 3.5.5.2, 3.5.6.2, 3.5.7.2, 3.5.8.2, 3.5.9.2, 3.5.10.2, 3.5.11.2, 3.5.12.2, 3.5.13.2, 3.5.14.2, and 3.5.15.2) The impacts of PDM on predator populations are discussed in Section 3.5.

The EA's analysis of need for PDM is flawed.
We disagree with the assertions that there is no need for PDM in Montana, and that we failed to adequately justify the need for PDM in this EA. The need for PDM was thoroughly assessed throughout Section 1.11, including the need to protect livestock (Section 1.11.2), agriculture resources and property (Section 1.11.3), humans and pets (Section 1.11.4), and disease surveillance (1.11.5). We used the best available data in this EA. In Section 1.11, this includes NASS data and APHIS Veterinary Services data, which are based on reports by livestock producers, as well as WS-Montana MIS data. These data are presented in Tables 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11 and Figure 1.1. These data show that many Montana predator species affect livestock, property, humans, and pets.

The data presented throughout Section 1.11 demonstrate the damage and damage threats posed by most of the predator species included in this EA, including coyotes, gray wolves, grizzly bears, black bears, mountain lions, raccoons, striped skunks, red fox, feral dogs, bobcats, badgers, feral cats and common ravens. Some predator species included in the EA have not been documented to impact livestock. However, the EA covers all damage caused by predators, not just livestock depredation, as discussed in Section 1.11. Specific types of predator damage are also addressed in the EA for each target predator species considered, in Sections 3.5.2 through 3.5.15. Damage caused by some predator species in this EA is occasional and sporadic.

Some comments suggest that predators only prey on sick or unhealthy animals. This is incorrect. Predators might selectively prey on vulnerable individuals. This vulnerability includes illness, and many other factors. Livestock are inherently vulnerable due to their domestication and selection for economically important traits.

We disagree with the implication that losses due to non-predation causes negate the need for PDM. We added information to the Final EA in Section 1.11.2.2 addressing and discussing other causes of livestock losses, and included our reasoning for not discussing them further. Livestock losses due to causes other than predation do not negate or affect our analyses. Section 1.11 includes a discussion of the sheep and lamb predator and nonpredator death loss in the United States report (APHIS Veterinary Services 2015) and the death loss in U.S. cattle and calves due to predator and nonpredator causes (APHIS Veterinary Services 2017).

One commenter asserted that we failed to include the number of entities assisted, the percentage of livestock producers who benefit, for whom services will be provided, the economic importance of ranching, livestock loss compensation programs, and the proportion of livestock losses attributable to predation. The commenter further asserted that the lack of this information is a failure to show sufficient need for PDM. We disagree with these assertions. The need is established in Sections 1.11.2 and 1.11.2.5, where the number of livestock depredated or injured by predators is shown (Table 1.6). Also, the importance of ranching is addressed in Section 1.11.2.1. The proportion of livestock losses attributable to predation is addressed in Section 1.11.2.3, and in the VS survey data cited in Section 1.11 (USDA Veterinary Services 2015, 2017).

Commenters claim that the EA lacks an adequate baseline to support analysis.
We disagree with this assertion. The "no action" alternative is the Preferred Alternative (Alternative 1) for the reasons discussed in Section 2.2. A description of the “environmental baseline” is included in Section 1.10.3. We also clarified this in Section 3, stating that the proposed action/no action alternative (Alternative 1) was assessed against the environmental baseline, and that Alternative 1 was then used as the benchmark for comparisons among the Alternatives. In other words, Alternatives 2, 3, 4 and 5 were compared to the proposed action (Alternative 1) for each issue to determine if real or potential impacts would be higher, lower, or approximately the same. We used this method of comparison because it is the most efficient and effective way to compare the alternatives, as stated in Section 3. If the commenter means that the "environmental baseline" should have been the "no WS-Montana PDM Program" alternative, this is Alternative 5, which was analyzed in detail in Section 2.3.5.

Commenters claim that ecological impacts of PDM are not evaluated in detail.
We agree with the assertions that healthy ecosystems are important, and that native predators play important roles in maintaining healthy ecosystems. Some commenters have claimed that WS-Montana’s opinion is that predators are not important for ecosystem health, and that the EA fails to give proper consideration to the positive values of carnivores, including ecosystem services, recreation, and eco-tourism. These are false assertions. One of the objectives of WS-Montana is to "Implement PDM so that cumulative effects do not negatively affect the viability of any native predator populations," as discussed in Section 1.5.2.1.2. The importance of predators to their ecosystems is discussed or referenced in Sections 1.4.1, 1.4.2, 1.4.3, 1.5.2.1.2, 1.7, 1.13.6, 3.8, 3.9.1, 3.11, and 3.12. The information in these Sections demonstrates WS-Montana's belief and understanding that predators are important parts of their ecosystems. The discussions in Chapter 3 are especially demonstrative of this. Trophic cascades were discussed in Section 3.8, and the potential for Alternative 1 to result in trophic cascades was analyzed in Section 3.8.4.1. Further discussion of trophic cascades can be found in Appendix F.

Commenters claim that analysis of the effectiveness of lethal PDM methods is insufficient.

The lethal PDM methods discussed in the EA have been shown to be effective in resolving conflicts with mammalian predators (Sections 1.12, 1.13, 2.3.1, 3.5, and Appendix A). According to the analysis in the EA, WS-Montana's integrated approach to PDM, including both nonlethal and lethal methods, is the most effective in resolving conflicts with mammalian predators (Sections 3.5.16.1 through 3.5.16.5). The literature we cited in these Sections and elsewhere in the EA supports the value and efficacy of lethal PDM.

We disagree with the assertion that lethal PDM results in more livestock depredation and higher losses, as discussed in Section 3.3.4. The research of Peebles et al. (2013) and Lambert et al. (2006) was considered for inclusion in the EA. Lambert et al. (2006) did not study the impacts of mountain lion removal on livestock losses, but speculated that there might be a positive correlation, based on the results of their study. Peebles et al. (2013) found a correlation between lethal removal of mountain lions through heavy hunting, and livestock depredation; however, this correlation does not demonstrate causation. These documents were not included in the EA because it did not add substantively to the information or analyses provided.

We agree that coyotes alter their breeding behavior and immigration strategies in response to lethal removal, as discussed in Section 3.3.4 and 3.5.2.2. We disagree with the assertion that these strategies infer that lethal PDM is ineffective, as discussed in Section 3.5.2. The documents provided by commenters have been considered. They do not add substantively to the information or analyses in the EA (Table 5.2).

We disagree with the assertions that the EA fails to include a cost-benefit analysis, and that a cost-benefit analysis is required by NEPA. NEPA does not require formal cost-benefit analyses for every federal action, as discussed in Section 1.19. Nonetheless, the EA contains a thorough discussion of economic analysis in Section 1.13, cost-benefit audits by OIG and GAO in Sections 1.12.2.1 and 1.12.2.2, and recent studies on the cost-effectiveness of WDM (many of which were conducted by APHIS-WS) in Sections 1.13.3 and 1.13.4.

We disagree with the assertions that preventive PDM is not effective, and may exacerbate losses. We are not aware of any credible data or research to support this claim. We discussed the effectiveness of APHIS-WS PDM Programs, including preventive PDM, in Sections 1.12 and 1.13 as noted in this response above.

We disagree with this assertion that surrounding producers experience increased depredation losses after lethal PDM. We are not aware of any credible data or research which would support this assertion. Some authors cited by other commenters (e.g., Santiago-Avila et al. 2018) have suggested that this may be the case for wolf removal; however, their data are not convincing due to their study design, small sample size, and lack of statistically significant results.

It is a false assertion that WS data document that lethal PDM does not work. It is unclear how the commenter believes that WS data would support this assertion. If the commenter is referring to the continued take of similar numbers of predators, mostly coyotes, every year, which demonstrates that the coyote population is not declining due to PDM, then the commenter misunderstands the objectives of the WS-Montana PDM Program, as discussed in Section 1.5.2.1.2.

Commenters claim that the EA fails to provide a detailed analysis of the adverse impacts of PDM on recreation.
This is a false assertion. The potential for PDM to impact recreation on public lands was discussed and analyzed in detail throughout Section 3.12.

We disagree with the assertion that Alternative 1 would result in decreased opportunities for wildlife viewing. We understand that many people appreciate wildlife viewing opportunities, as discussed in Section 1.4.2. We considered the impacts of Alternative 1 on wildlife viewing, including photography, in Section 3.12.3.1, and determined that there would be no significant impact. This analysis includes consideration of the presence and abundance of wildlife species available for viewing, which was analyzed in Sections 3.5.16.1, and determined to not result in any significant impact under Alternative 1. Any potential deficiencies within wildlife populations which might decrease opportunities for wildlife viewing are neither caused by nor contributed to by WS-Montana, as analyzed and discussed in Sections 3.5.16.1, 3.6.5.1, and 3.7.1.1.

We disagree with the assertion that WS-Montana PDM distresses recreationists. As stated in Section 3.12.3.1, 83% of WS-Montana PDM occurs on private land at the request of cooperators. These cooperators determine the components that may be used on their property when they may be used, minimizing conflicts with recreationists. Furthermore, on public lands, WS-Montana coordinates with the public land management agencies through AWPs or other means and designates different work zones on maps to reduce potential problems. For example, public safety zones are designated on maps associated with the AWP and WS-Montana does not set equipment within a ¼ mile of these areas. WS-Montana does not conduct IPDM in high use recreational areas except for the purposes of human health and safety protection and only after receiving a request from the applicable public land management official. High use recreation and other sensitive areas are identified at a site-specific level in WS-Montana AWPs on maps or as new damage situations arise. Public safety zones, planned control areas, and restricted or coordinated control areas are identified through interagency coordination.

We disagree with this assertion that Alternative 1 will result in decreased income from ecotourism, based on the information and analysis provided throughout Section 3.5.16.1. We have considered Leonard 2008. The amount of income generated by wildlife watching is outside the scope of the EA; as discussed and analyzed in Section 3.12.3.1, Alternative 1 would not result in any significant impacts on the use of public lands for recreation. This is supported by the analyses in Sections 3.5.16.1, 3.6.5.1, and 3.7.1.1, which showed that Alternative 1 would not significantly impact wildlife populations. We disagree with the assertion that these recreation areas are often where WS-Montana conducts lethal PDM. As discussed in Section 1.9.4, 1.11.2.9, and 3.5.1, most WS-Montana PDM is conducted on private lands. In addition, PDM conducted on public lands is not generally conducted in areas of recreation, including wildlife watching, as discussed in Section 3.12.3.1.

Another issue that was discussed was the purported impact that PDM would have on sportsmen. Game and non-game wildlife populations are not significantly impacted by WS-Montana PDM take, allowing hunters and trappers ample opportunities for pursuit during seasons set by MFWP. WS PDM is highly directed to target individuals and species in a given area, mostly on private lands, and can be conducted in low to high density predator areas. Typically, WS-Montana works on a property until damage is controlled. This can take longer than sportsmen would tend to stay or be allowed to legally harvest in a given area. Additionally, WS-Montana only conducts PDM in a small portion of Montana. Private fur harvesters tend to hunt and trap where furbearer populations are high. When the only monetary benefit is fur value, they cannot make a profit by pursuing individual depredating coyotes in local areas where numbers are low. In addition, furs are only prime in the winter months and are not of value at other times of year when PDM is frequently needed. The typical strategy of private fur takers is to hunt the more easily lured animals in a population, which tend to be the younger and less experienced animals, and then move on to other areas. With coyotes, older individuals are the most prone to being livestock and wild ungulate killers (Connolly et al. 1976, Gese and Grothe 1995). Thus, offending animals would not likely be removed by private fur takers, which means depredation losses would often be about as severe as they would without private fur harvest. This issue remains basically the same under all of the alternatives.

There may be a marginal decrease in recreational coyote, fox, and bobcat hunting opportunities. This decrease would be marginal because take by WS-Montana will be a relatively small percentage of the overall take under Alternative 1. See Section 3.5.16.1 for a detailed analysis of the impacts to these target predator species.

5.3 EIS

Commenters state the need for the preparation of an EIS, for reasons other than significant environmental impacts. Commenters assert that an EIS is required due to the breadth and scope of the project and intensity factors (40 C.F.R. § 1508.27).
We disagree with the assertion that an EIS is required based on the breadth and scope of the project. The breadth and scope of the EA fits within the guidelines for an EA per APHIS' NEPA implementation regulations at 7 CFR 372.5.
We disagree that any of the specific intensity factors asserted by these commenters below requires the preparation of an EIS:

(1) the degree to which the proposed action affects public health or safety

- Concerns related to the EA relative to *40 C.F.R. § 1508.27(b)(2): the degree to which the proposed action affects public health or safety* are addressed in Sections 3.10.1.5.1, 3.10.2.7.1, 3.10.3.5.1 of the EA. WS-Montana does not conduct IPDM in high use recreational areas except for the purposes of human health and safety protection and only after receiving a request from the applicable public land management official. In addition, when working on public lands, WS-Montana coordinates with the public land management agencies through AWPs or other means and designates work zones on maps to reduce potential problems.

(2) unique characteristics of the geographic area such as proximity to historical or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas

- Concerns related to the EA relative to *40 C.F.R. § 1508.27(b)(3): unique characteristics of the geographic area such as proximity to historical or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas* are addressed in Section 3.3 of the EA. The issues raised in this comment are commonly raised by the public (USDA Wildlife Services 2011;2014a;2016) and although they are considered in the development of this EA, they are not considered in the detailed discussion for the reasons identified in Section 3.3 as these resources are not significantly impacted by APHIS-WS and WS-Montana operations (USDA Wildlife Services 2011;2014a;2016).

(3) the degree to which the effects on the quality of the human environment are likely to be highly controversial, and to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks

- Concerns related to the EA relative to *40 C.F.R. §§ 1508.27(b)(4) and (b)(5): the degree to which the effects on the quality of the human environment are likely to be highly controversial, and to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks* are addressed in Chapter 3 of the EA. Our analyses in Chapter 3 demonstrate that the Preferred Alternative (Alternative 1) would not significantly impact the environment. We have considered the references provided by commenters, and some authors disagree with our conclusions. However, NEPA does not require WS-Montana to settle disputes among researchers.

(4) the degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration

- Concerns related to the EA relative to *40 C.F.R. § 1508.27(b)(6): the degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration* have been raised. WS-Montana has evaluated potential risks and effects. Alternative 1 is not highly controversial and does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration.

(5) whether the action is related to other actions with individually insignificant but cumulatively significant impacts

- Concerns related to the EA relative to *40 C.F.R. § 1508.27(b)(7): whether the action is related to other actions with individually insignificant but cumulatively significant impacts* are addressed in Section 3.5 of the EA. The issue of potential effects on populations of predator species drives the analysis of the direct effects of WS-Montana's intentional lethal IPDM activities, and the cumulative effects that include all other known sources of predator mortality. WS-Montana, its cooperating agencies, and the public are concerned with the effects of removals on the viability of predator populations. The effects on each species is evaluated using the best available information including the scientific literature and detailed take information from WS-Montana's MIS database and reported take from MFWP, MDOL, and USFWS databases. The potential for cumulative effects is an integral part of this process.

(6) the degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973, and (7): whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment

- Concerns related to the EA relative to *40 C.F.R. § 1508.27(b)(9): the degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973* are addressed in Sections 2.4 and 3.6, and Appendix B of the EA. It is a false assertion that the EA contemplates violations of law, including the Endangered Species Act and the Wilderness Act. Alternative 1 would not violate any laws. Our compliance with federal, state, and local laws is stated throughout the EA.

The reasons we prepared an EA instead of an EIS are provided in Section 1.10. We disagree with the assertion that an EIS is required due to unique or unknown risks. Section 1.10.2.2 contains language regarding Unique or Unknown Risks, based on the CEQ regulations at 40 CFR §1508.27(b)(5), which demonstrates how we included this issue in our analyses. We included consideration the degree of uncertainty and unique or unknown risks in our analyses in Chapter 3, and determined that there would be no significant impacts under Alternative 1. Some commenters have asserted that certain statements in the EA meet the threshold of unknown risks, thus requiring the preparation of an EIS. We disagree that these statements or any of the analyses or statements in the EA meet this threshold.

We disagree with the assertion that an EIS is required due to highly controversial methods or impacts under Alternative 1. This is discussed in Sections 1.10.2.1. Our analyses in Chapter 3 demonstrate that the Preferred Alternative (Alternative 1) would not significantly impact the environment. We did not find that the magnitude of the impacts would be highly controversial. We have considered the references provided by commenters. Many of these authors disagree with our conclusions in the EA. However, NEPA does not require WS-Montana to settle disputes among researchers.

We found that there would be no significant impacts under Alternative 1 (Sections 3.5.16.1, 3.6.5.1, 3.7.1.1, 3.8.4.1, 3.9.6.1, 3.10.1.5.1, 3.10.2.7.1, 3.10.3.5.1, 3.11.1, and 3.12.3.1); thus, an EIS is neither warranted nor required.

Commenters claim that WS-Montana should prepare an Environmental Impact Statement instead of an Environmental Assessment due to adverse effects.

Lead

We disagree with the claim that this EA improperly downplays the risks associated with adding lead to the environment through the use of lead ammunition. WS-Montana used the best available science and information to conduct its analysis and determined that the programmatic use of lead ammunition by WS-Montana would not result in a significant impact on the environment for the reasons discussed in Sections 1.10.2.4 (Cumulatively Significant Impacts), 2.4.3.3 (Miscellaneous Measures), 3.10.2 (What are the Potential Impacts and Risks from the Use of Lead Ammunition?). WS-Montana will use non-lead ammunition when required by land management policies and as required by Federal, state, and tribal laws and when and where required by ESA Section 7 consultations in compliance with Federal and State regulations. In addition, APHIS-WS has conducted a thorough risk analysis on lead use in wildlife damage management (USDA Wildlife Services 2017h).

Aerial gunning

WS-Montana disagrees that aerial gunning is inherently inhumane, and that WS-Montana dismisses the impact of noise and overpasses. Aerial hunting is discussed in Section 3.1.1.1.1 of the EA (What are the Potential Risks to the Health and Safety of WS-Montana Employees during Aerial Activities?). In addition, WS has conducted a risk assessment for the use of aircraft in WDM (USDA Wildlife Services 2019a).

Traps and Snares

WS-Montana might use several types of traps under Alternative 1, and these are discussed in Appendix A. We disagree with the assertions that use of traps and snares under Alternative 1 would result in significant impacts on human safety, pet safety, non-targets, threatened and endangered species, public lands, and wilderness areas. We also disagree with the assertions that traps and snares are indiscriminate and inhumane. The potential for traps and snares to impact non-target animals, threatened and endangered species, human and pet safety, public lands, and wilderness areas was included in our analyses in 3.6.5.1, 3.7.1.1, 3.9.6.1, 3.10.1.5.1, 3.10.2.7.1, 3.10.3.5.1, 3.11.1, and 3.12.3.1. These analyses include the citation of the APHIS-WS risk analysis on the use of foothold traps (USDA Wildlife Services 2019h). Protective measures for the use of traps and snares by WS-Montana are included in Section 2.4. Further information on trapping and snaring practices is provided in Appendix A. Traps and snares pose little risk to humans, and during the five-year analysis period of the EA (FY13-17), no humans were directly impacted by any traps or snares set by WS-Montana. Only one pet/livestock animal (not differentiated in the MIS database) was unintentionally captured in FY 2013 through FY 2017 while conducting IPDM when it was caught in a foothold trap by WS-Montana (Table 3.19). The animal was subsequently released without harm. During that same period, six feral/free-ranging dogs were caught in foothold traps and neck snares and were released unharmed (Table 3.19). Unintentional capture and/or take does occur, however, it is a rare and infrequent event.

Much research has been conducted since the 1990's on traps and snares to make them more humane to animals, more efficient at catching wild animals, more effective, more selective at catching target animals and avoiding non-target animals, and lastly to make traps more safe for people. The Best Management Practices for Traps was the international process used by Canada and the United States to improve the animal welfare, efficacy, efficiency, selectivity and safety of traps. This process is discussed in the EA at Section 3.9.4. These improvements have resulted in the replacement of older traps with their many flaws. Traps have advanced significantly as improvements to use these devices has advanced in leaps and bounds in the last 20 years. The same can be said for snares which are misunderstood by most of the public.

While traps and snares are less selective than other methods, such as aerial PDM, traps and snares can be highly selective when used appropriately by knowledgeable and experienced wildlife professionals, as discussed in Section 2.4, throughout Chapter 3, and in Appendix A. As discussed in Section 2.4 and Appendix A, WS-Montana employs various protective measures to make all methods as selective as possible. WS-Montana also consulted with the USFWS to minimize the likelihood that the use of traps and snares would impact any threatened or endangered species in Montana. WS-Montana non-target take was discussed and analyzed in Section 3.7.1.1, including non-target take from traps and snares. The minimal amount of non-target take anticipated under Alternative 1 was not determined to result in any significant impact to non-target wildlife, including threatened and endangered species (Sections 3.7.1.1 and 3.6.5.1).

Finally, commenters cite the work of Iossa et al. (2007) regarding the humaneness of a variety of traps. However, traps used in the United States and elsewhere have undergone extensive standards testing and selection as part of an international effort to optimize trap humaneness, selectivity, and effectiveness (Batcheller et al. 2000, Association of Fish and Wildlife Agencies 2006, White et al. 2015) which was partially funded by the WS program (Association of Fish and Wildlife Agencies 2006). Iossa et al. (2007) in fact calls for the types of improvements noted above, and cite Proulx (1999) and other sources, most of which predate the trap standards work mentioned above. In fact, of the first 100 references cited in Iossa et al. (2007) (Iossa et al. 2007), just 3% were published the year the AFWA BMPs were finalized, and the other 97% predated it. Consequently, the stated concern doesn't apply to current technologies. WS-Montana discussed humaneness and ethical perspectives of Alternative 1 in Section 3.9.6.1. This discussion includes the use of traps and snares. Protective measures are discussed in Section 2.4. The humaneness of trapping, including trapping BMPs are addressed throughout the EA, including Sections 1.10.2.1, 3.2.4, 3.4.2, and 3.9.

Chemical fumigants

Sodium Nitrate is used by WS-Montana in gas cartridges. Gas cartridges are pyrotechnic fumigants used to target animals that live in burrows or dens, such as coyotes, skunks, and badgers. The cartridges contain the active ingredients sodium nitrate ($NaNO_3$) and charcoal, combined with two inert ingredients, Fuller's earth and borax. This compound's safe and humane use is described in Section 3.10.3.2 and Appendix A of the EA, and dictated by WS Directive 2.465. In addition, APHIS-WS has conducted a thorough risk assessment the use of gas cartridges in wildlife damage management (USDA Wildlife Services 2017e).

M-44s

We disagree with the assertion that the risk of human and pet exposures to sodium cyanide from the use of M-44 devices is significant. Human and pet exposures from the use of M-44s are rare and unpredictable events, and WS-Montana follows numerous preventive measures, use restrictions, EPA regulations, and APHIS-WS policies to reduce the likelihood of such an occurrence. A Use of Sodium Cyanide in Wildlife Damage Management Risk Analysis (USDA Wildlife Services 2019i) determined the minimum safe distance M-44 devices could be set around occupied residences. Discussion of the risk analysis' findings by the APHIS Administrator and WS Management Team resulted in the requirement that M-44 devices be placed at least ½ mile from occupied residences and that residences near the ½-mile perimeter be notified of the presence of the devices. APHIS personnel who work with M-44s are specially trained and certified to ensure they comply with WS-Directive 2.415 (M-44 Use and Restrictions Updated 5/14/2020). WS-Directive 2.415, which contains detailed guidance to WS personnel for the placement of M-44 devices and how local areas are informed of M-44 locations, can be accessed for public review on the USDA APHIS website (https://www.aphis.usda.gov/wildlife_damage/directives/pdf/2.415.pdf). The updated WS M-44 use policies and restrictions further reduce the risk to public safety, pets, nontarget species, and the environment. APHIS Wildlife Services understands the public's concern regarding the use of M-44s and is committed to the safe and responsible use of these devices.

We disagree with the assertions that human or pet health or safety would be significantly impacted under any alternatives in the EA. We also disagree that M-44 devices are indiscriminate, inhumane, and that they would pose secondary hazards or contaminate groundwater. Potential impacts to human and pet safety were analyzed in Sections 3.10.1.5.1, 3.10.2.7.1, and 3.10.3.5.1 of the EA. Non-target take under Alternative 1 was analyzed in Section 3.7.1.1, which includes any take of pets. In addition, APHIS-WS has conducted a thorough risk assessment the use of sodium cyanide in wildlife damage management (USDA Wildlife Services 2019i).

Drugs used in immobilization and euthanasia

Immobilization and euthanasia drugs are discussed in Section 3.10.3 of the EA. Use of these chemicals is in accordance with WS Directives 2.401 and 2.465 (Section 2.4.1), all hazardous materials and pesticides are applied, certified, stored, transported, shipped, disposed of and use supervised in compliance with applicable federal, State, Tribal, and local laws and regulations. In addition, all storage, transportation, inspections, training, and emergency procedures are conducted according to Appendix 1 of WS Directive 2.401.

5.4 Humaneness

Commenters claim that the EA does not adequately assess humaneness of certain PDM methods.

We disagree with the claim that the EA fails to take a hard look at the humanness of PDM. As discussed in Section 3.9, WS-Montana understands that PDM may not be acceptable to some individuals based on their values and/or beliefs. Humaneness and ethics are discussed in Sections 3.9.; humaneness and ethics issues under Alternative 1 are discussed in Section 3.9.6.1. The protective measures implemented by WS-Montana, as discussed in Section 2.4, and the descriptions of methods provided in Appendix A, provide further information on the humaneness of WS-Montana implementation of PDM. Selectivity of the various methods also relates to humaneness. More selective methods are considered more humane methods, because they reduce unnecessary pain and suffering in non-target animals. As discussed throughout the EA, WS-Montana uses the most humane and selective methods practical for each predator damage situation.

WS-Montana personnel are skilled professionals who abide by applicable laws and regulations for trap use. Additionally, WS-Montana personnel abide by the species-specific AFWA Trapping BMPs, which were most recently updated in 2020. Additionally, Section 3.9 explains how APHIS-WS approaches humaneness, ethics, and animal welfare.

5.5 Science

Commenters state that Wildlife Services must place value on peer-reviewed studies that can be replicated, are objective, and have been published within the last decade.

We agree with this statement insofar as studies must be able to be replicated and be objective. In the development of this EA, we used the most applicable and comprehensive studies available. The assertion that studies published before 2011 are not valid is completely without merit and therefore will not be considered. The science and practices of wildlife damage management are discussed in Section 1.4.4.

Commenters claim that the EA fails to consider the best available science.

We disagree with the assertions that WS-Montana did not use the best available science in the EA, used outdated science, ignored dissenting scientific documents and opinions, or failed to consider important relevant documents. We used the best available information and science in the preparation of the EA, as stated in Sections 1.4.4 and 1.12.4. We considered numerous documents which were relevant to the topics in the EA, but did not add substantively to the information and analyses in the EA. This was largely because we cited other references which contained similar information for the purposes of the analyses. We did not cite these documents as references in the EA because we believe they do not add substance to the EA. Not all studies were cited; only those which added substantively to the information and analyses in the EA. Dissenting opinions and documents with dissenting data and conclusions were included throughout the EA. WS-Montana is not obligated to settle disputes regarding opposing opinions or disagreements among scientific experts. According to CEQ, only a reasoned analysis of the evidence is required.

The EA contains some older citations generally related to species biology that has not changed in hundreds of years, or historic population trends provided as background information for the analysis. WS-Montana reviewed and cited the best available science in the preparation of this EA, with extensive literature citations provided in Chapter 4 and Appendix F. These citations include relevant studies from among the papers that the commenters provided during public comment.

5.5.1 Documents Submitted with Comment Letters

We received documents attached to various comments that were already incorporated into the EA and cited herein. These documents are listed in Table 5.1.

Table 5.1. Documents Incorporated and Cited in the EA.

Bradley et al. 2015, effects of wolf removal
Bryan et al. 2014, hunting pressure on wolves
Callen et al. 2013, trophic cascade
Cooley 2009, hunted cougar population regulation
Crooks and Soule 1999, mesopredator release
Henke and Bryant 1999, effects of coyote removal
Iossa et al. 2007, animal welfare mammal trapping
Mezquida et al. 2006, predator control and sage grouse
Poudyal et al. 2016, lethal wolf management
Shivik 2006, predator management techniques
US Census Bureau 2016, national survey for fishing, hunting, and associated recreation
USFWS 1993, grizzly bear recovery plan
Wagner and Conover 1999, coyote predation
Waser et al. 2014, trophic cascade
Winnie and Creel 2017, trophic cascade
Wielgus and Peebles 2014, wolf mortality on livestock depredations

We received documents attached to comments that were previously considered during the preparation of the EA. The following were not cited because they do not add substantively to the information and analyses in the EA. These documents are listed in Table 5.2.

Table 5.2. Documents Considered but Not Cited in the EA.

Bergstrom et al. 2013, biodiversity and ecosystem function
Carter et al. 2019, greater consideration of ecological impact of predator control
Davidson-Nelson and Gehring 2010, testing turbo fladry
Eisler 1991, cyanide hazards to fish, wildlife, and invertebrates
Fernández-Gil et al. 2015, brown bear and wolf management
Gehring et al 2010, livestock protection dogs

Gehring et al. 2011, good fences make good neighbors
Keefover-Ring 2009, war on wildlife report
Khorozyan and Waltert 2020, effectiveness of PDM for livestock
Knudson 2012, newspaper article, the killing agency
Kompaniyets and Evens 2017, wolf management
Lennox et al. 2018, efficacy of predator control
Miller et al. 2016, effectiveness of PDM
Moreira-Arce et al. 2018, effectiveness of PDM
O'Néill et al. 2007, monitoring foothold traps with mobile phone
Proulx et al. 2015, humaneness of snares
Ripple et al. 2014, trophic cascade
Roberts et al. 2011, exposure to traumatic events
Rochlitz et al. 2010, snares on animal welfare
Santiago-Avila 2018, wolf management
Sasse 2003, job-related mortality
Treves et al. 2017, predators and public trust
Treves et al. 2018, regulations and hunting as conservation
Treves et al. 2019, predator control
USDA Office of Inspector General 2005, semiannual report to Congress
Van Eeden et al. 2018a, effectiveness of PDM
Van Eeden et al. 2018b, effectiveness of PDM

We received documents attached to various comments that had not yet been considered during the preparation of the EA. We considered these documents upon receipt from the commenter during the preparation of this Final EA. These fall into two categories: (1) not cited because they do not add substantively to the information and analyses in the EA (Table 5.3), and (2) added to and cited in the EA because they contained useful information (Table 5.4).

Table 5.3. Documents not cited because they do not add substantively to the information and analyses in the EA.

Andreasen et al. 2018, cougars caught in nontarget traps
Bragina et al. 2019, deer populations following coyote colonization
Dufour (undated), coyote life history
Few et al. 2019, nonlethal predator management collaboration
International Organization for Standardization 1999, mammal traps
Khorozyan and Waltert 2019, effectiveness of PDM
Lambert et al. 2006, cougar population dynamics
Missouri Dept. of Conservation (undated), coyote field guide
Mulhollem 2016, Pennsylvania Game Commissioners reply to Unified Sportsmen of Pennsylvania on predator questions
Ohrens et al. 2019, nonlethal cougar management method
Peck et al. 2017, grizzly bear gene flow
Peebles et al. 2013, cougar hunting on livestock depredations
Radford et al. 2020, nonlethal predator management method
Rippe 1995, predator control bulletin
Sacks et al. 2009, coyote removal
Sax 1970, public trust doctrine

Thomas 2013, lead-free hunting rifle ammunition
US Census Bureau 2011, national survey of fishing, hunting, and wildlife associated recreation
Voyles et al. 2015, impacts of black bear management
Young et al. 2018, nonlethal management strategies

Table 5.4. Documents added to and cited in the EA

Treves et al 2016, predator control should not be a shot in the dark
USFWS 2017, species status assessment for the Canada lynx

We received documents attached to comments that were reviewed and determined to be outside the scope of the EA. These documents are listed in Table 5.5.

Table 5.5. Documents Outside the Scope of the EA

Bauer et al. 2018, bird damage management
Beggs et al. 2019, bird damage management
Illinois Dept. of Natural Resources 2019, Illinois hunting and trapping regulations
Imbert et al. 2016, wolf diet in northern Italy
North Carolina Wildlife Resources Commission 2018, North Carolina coyote management plan
Ruth 2014, deer harvest
West Virginia Dept. of Natural Resources, impacts of eastern coyote on wildlife populations
Woodroffe and Frank 2005, lethal management of African lions

5.6 Non-Lethal

Commenters claim that non-lethal PDM is more effective at reducing livestock losses than lethal PDM.
WS is unaware of any data that demonstrate that using non-lethal methods alone is more effective than the integrated PDM program proposed in Alternative 1. WS-Montana recommends and employs a variety of non-lethal methods that are detailed in Appendix A. Justification for the use of lethal PDM methods can be found in Section 1.12.5.

Commenters state that Wildlife Services should prioritize nonlethal PDM when responding to requests for assistance.
We agree with this statement. WS-Montana recommends a variety of non-lethal techniques to cooperators, which are detailed in Appendix A. We also employ a full-time permanent conflict prevention specialist, a full-time seasonal conflict prevention specialist, and two full-time seasonal range riders who only use non-lethal methods. Our commitment to utilizing and expanding the use and availability of non-lethal methods is detailed throughout the document. Additionally, all WS-Montana personnel give preference to non-lethal methods when practical and effective, per APHIS-WS Directive 2.101 (Section 1.5.2.3).

A commentor states that resource owners should incorporate livestock guarding dogs.
As discussed in Appendix A, we believe the livestock guarding animals can be effective at minimizing and preventing human-wildlife conflicts.

5.7 Grizzly Bears

Commenters claim that the 2012 biological opinion on grizzly bears is outdated.
Because reasonable and prudent measures set forth in the Biological Opinion (Section 2.4.2.1) are adhered to and reinitiation requirements have not been met (Section 3.6.4.1), there is no reason to initiate new consultation for grizzly bear at this time. USFWS cooperated in the development of this EA. WS-Montana continues to monitor the most recent applicable science and defer to the direction of USFWS in matters of grizzly bear management.

Commenters state that the EA must meaningfully consider connectivity which means having a better understanding of the cumulative impact of removing bears outside the DMA's.
Bears outside of recovery zones and DMAs are not part of an established population, therefore cumulative impacts cannot be adequately measured as population data does not exist for these areas (Section 3.5.11.2). If this changes, WS-Montana will issue a supplement to this EA to address the changes. As stated in Sections 3.5.11.2, 3.5.11.3, 3.5.11.3.3, 3.5.11.4, and 3.6.4 the final disposition of grizzly bears captured by WS-Montana is decided by USFWS, not WS-Montana. Any take by WS-Montana would be requested and permitted by USFWS. Because USFWS monitors population trends and mortality, it is unlikely that WS-Montana would lethally remove grizzly bears in a manner that would negatively affect their populations.

Commenters state that WS-Montana must ensure that lethal management of grizzly bears, particularly in smaller populations like the Cabinet-Yaak, is strictly limited especially in the case of females.
As stated in Sections 3.5.11.2, 3.5.11.3, 3.5.11.3.3, 3.5.11.4, and 3.6.4 the final disposition of grizzly bears captured by WS-Montana is decided by USFWS, not WS-Montana. Any take by WS-Montana would be requested and permitted by USFWS. Because USFWS monitors population trends and mortality, it is unlikely that WS-Montana would lethally remove grizzly bears in a manner that would negatively affect their populations, as determined in Section 3.5.11.3.3. Furthermore, the protective conditions detailed in Section 2.4.2.1 minimize the potential for unintentional grizzly bear take.

Commenters state that lethal removal of grizzly bears by WS-Montana must be clearly tracked and available to the public.
Any take of grizzly bears by WS-Montana is requested and permitted by USFWS, as stated in Sections 3.5.11.2, 3.5.11.3, 3.5.11.3.3, 3.5.11.4, and 3.6.4, therefore 4(d) take report forms are submitted to USFWS by WS-Montana or cooperating agencies such as MFWP or the Blackfeet Nation. Furthermore, fiscal year reports on WS-Montana operational activities are posted online at
https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/SA_Reports/SA_PDRs.

5.8 Public Perception

A commenter claims that public confidence in WS has been undermined.
WS-Montana disagrees with this claim. The views of independent organizations or individuals do not necessarily represent the views of the majority of the general public.

Commenters claim that WS-Montana PDM actions are opposed by the majority of the American public.
WS is unaware of any data that details public opinions on WS-Montana PDM activities. As stated in Section 1.13.6.1, because wildlife belong to the American public, it is national policy that some of the resolution of damage caused by those same species is also publicly supported. Within the constraints of WS-Montana decision-making, we believe that the proposed EA works in good faith to preserve predator populations and their role in ecosystems for current and future generations. WS-Montana also consults extensively with state and federal agencies to ensure consistency with their land management plans, which is explained in Sections 1.8. WS-Montana monitoring of program actions will help to ensure that new information on predator biology, the role of predators in ecosystems, efficacy of nonlethal and lethal PDM methods, and the human dimensions of predator management are considered and included in program decision-making, as appropriate.

Commenters claim that killing native wildlife on public lands violates the public trust doctrine.
WS-Montana disagrees with these assertions. The Act of March 2, 1931 authorizes the Secretary of Agriculture to conduct a program of wildlife services. As amended in 1987, congress explicitly authorized Wildlife Services "to control nuisance mammals…". WS-Montana continues to act under that authority and in good faith with state and federal natural resource management partners (See EA Section 1.5.1).

The Public Trust Doctrine is the foundation of State and Federal wildlife management programs in North America. The basis for the doctrine in the United States was established by the Supreme Court in 1842 (*Martin v. Waddell)* and subsequently supported by other case law rulings during the 19th through the 20th centuries. The Doctrine establishes that wildlife is a natural resource that belongs to the public and that should be maintained through government programs in trust for the people, including future generations. APHIS-WS conducts wildlife damage management according to the Public Trust Doctrine and its underlying public stewardship principles, not to generate revenue and profit for the Government. The Doctrine guides the relationship between natural resources that are publicly owned, and the Government wildlife management programs that provide stewardship to maintain the resources for the benefit of the public and future generations.

5.9 Supportive Comments

We received several supportive comments, or comments with which we agree.

The following comments are generally supportive of the content and analyses in the EA, or provide statements with which we categorically agree. We appreciate these comments. These include:

- Agrees with the use of PDM, including lethal PDM.
- Generally agrees with the information, analyses, and determinations in the EA, which are sound.
- Supports the Preferred Alternative (Alternative 1).
- Appreciates that WS-Montana has full-time non-lethal specialists.
- Agricultural losses would be higher without WS-Montana's PDM Program.
- The need for PDM to protect livestock is considerable

5.10 General Comments

Commenters state that taxpayers should not fund PDM activities, or that they should not fund Lethal PDM activities.
We disagree with this statement. Section 1.13.6.1 contains a detailed description of the statutes and acts that provide justification for the use of taxpayer funds for PDM.

Commenters state that PDM actions benefit the livestock industry.
As stated in Section 1.2 it is the position of WS-Montana that we should respond to all requests for assistance regarding PDM. Many requests for assistance regarding PDM are agricultural in nature as stated in Section 1.11.2.7. The need for PDM is addressed in Section 1.11, including the need to protect livestock (Section 1.11.2), agriculture resources and property other than livestock (Section 1.11.3), humans and pets (Section 1.11.4), and disease surveillance (1.11.5). The use of taxpayer funding to benefit commercial interests is addressed in Section 1.13.6.1.

Some commenters requested a comment period extension.
A thirty-day comment period is required by CEQ regulations § 1501.6 (a)(2) under the National Environmental Policy Act of 1969. Several commenters requested an extension of the comment period. One of the requesters for an extension was WildEarth Guardians, who filed a Stipulated Settlement Agreement with WS on May 14, 2020, stating that WS expects to complete an EA and issue a decision by May 15, 2021. This timeline precludes consideration of an extended public comment period. Ample notice is provided via GovDelivery, The Helena Independent Record, and others, per CEQ regulations.

Commenters claim that MOUs should have been included as part of the EA.
We disagree with this assertion. All pertinent information from these documents has been included and explained in our assessment. Providing the full documents as part of the EA would not provide additional benefits. A discussion of WS-Montana's MOUs with other entities can be found in Section 1.8. Furthermore, copies of these MOUs are available by contacting the WS State Director's Office, P.O. Box 1938, Billings, MT 59101

Commenters claim that BOs should have been included as part of the EA.

We disagree with this assertion. All pertinent information from these documents has been included and explained in our assessment. Providing the full documents as part of the EA would not provide additional benefits. WS-Montana's potential effects on grizzly bears and Canada lynx are detailed in Sections 3.6.4.1 and 3.6.4.2 respectively. Furthermore, copies of these BOs are available by contacting the WS State Director's Office, P.O. Box 1938, Billings, MT 59101

M-44s should not be used in grizzly bear, Canada lynx, or wolf habitat.
WS-Montana abides by the M-44 use restrictions included in Section 2.4.1.6 and the protective conditions from the grizzly bear and Canada lynx biological opinions Section 2.4.2.1. WS-Montana personnel do not place M-44s in areas where there is grizzly bear, Canada lynx, or gray wolf sign. If the presence of grizzly bears, Canada lynx, or wolves is verified in the vicinity of emplaced M-44s, WS-Montana personnel will remove the devices.

Commenters claim that the EA does not contain a cost-benefit analysis.
Some comments assert that cost-benefit analysis was absent from the EA, or is required by NEPA. We disagree with the assertions that the EA fails to include a cost-benefit analysis, and that a cost-benefit analysis is required by NEPA. NEPA does not require formal cost-benefit analyses for every federal action, as discussed in Section 1.13.2. We disagree with the assertions that Alternative 1, or lethal PDM in particular, are not effective, or cost-effective. Based on the thorough discussion and analyses in Sections 1.12 and 1.13, the PDM proposed under Alternative 1, including lethal PDM, is an effective use of tax dollars. Cost-benefit audits by OIG and GAO were discussed in Sections 1.12.2.1 and 1.12.2.2; recent studies on the cost-effectiveness of WDM (many of which were conducted by APHIS-WS) were discussed in Sections 1.13.3 and 1.13.4; and other considerations were discussed in Section 1.13.6. Lethal PDM is part of the integrated PDM conducted by WS-Montana and APHIS-WS, and is therefore included in these analyses.

Commenters state that the EA should contain site-specific analysis for PDM activities.
We disagree that impacts in the EA should be measured at local, regional, or other levels for the reasons discussed in Sections 1.9.3, 1.9.4, 1.15.4, and 1.10.2, and within the impact analyses for individual target predator populations in Section 3.5.16.1. Further clarification of our reasoning was added to Section 1.2 and 1.9.2. Our analyses of potential impacts on statewide populations in Section 3.5.16.1 indicate that this level of analysis is not warranted, because the proportion of cumulative take contributed by WS-Montana is extremely low for all native predators targeted during PDM. There is no reason to believe that regional analyses would affect our analyses or conclusions.

We disagree with the assertion that we failed to provide an explanation as to why we chose to analyze impacts at the statewide population level. This information is presented in Sections 1.9.3, 1.9.4, and 1.15.4, and within the impact analyses for individual target predator populations in Chapter 3. Further clarification of our reasoning was added to the Final EA in Section 1.2 and 1.9.2.

Commenters claim that the EA fails to adequately consider the impacts of conducting its PDM activities on SMAs.

We understand that some individuals will not agree with the use of PDM in special management areas (SMAs), such as Wilderness Areas (WAs) and Wilderness Study Areas (WSAs). We considered an alternative to not conduct PDM in WAs or WSAs in Section 2.5.22. This alternative was not considered in detail for the reasons provided therein. Alternative 1, which includes PDM in SMAs, was analyzed in detail in Sections 3.5.16.1, 3.6.5.1, 3.7.1.1, 3.8.4.1, 3.9.6.1, 3.10.1.5.1, 3.10.2.7.1, 3.10.3.5.1, 3.11.1, and 3.12.3.1, and we determined that it would not result in any significant impact on the environment. This assessment includes SMAs such as WAs and WSAs in Section 3.11.1. In Table 3.22, we analyzed the ability of five alternatives to meet the goals and objectives of APHIS-WS and WS-Montana, and Alternative 1 was determined to best accomplish these.

We disagree with the assertion that the EA fails to adequately consider potential impacts on SMAs under Alternative 1. We thoroughly discussed and analyzed the potential impacts to SMAs under Alternative 1 in Section 3.11, including Tables 3.20. In table 3.20, we provided a non-exhaustive list of many of the SMAs in Montana, including 290 SMAs.

We disagree that the inclusion of site-specific analyses for all SMAs in Montana would be reasonable. Due to the infrequent and sporadic nature of WS-Montana's PDM work in SMAs, analyses for each SMA in Montana would be uninformative. NEPA requires an analysis of the impacts by looking at the issues as implemented under each alternative. WS-Montana conducts this analysis at the statewide level. It is redundant and adds nothing to the analysis to conduct the same analysis of the same issues and alternatives at a smaller scale because an analysis conducted at the statewide scale is more informative. Therefore, to look at site-specific analyses for each of the 290 SMAs in Montana is less informative than looking at the impacts statewide.

Commenters state that the EA fails to address consistency with land management plans.

We disagree with this statement. As stated in Section 1.8 WS-Montana works with land management agencies through agency specific MOUs. The AWPs referenced ensure that all WS-Montana activity on these lands are conducive to relevant land management plans. The analyses in Chapter 3 include WS-Montana activities on government managed public lands.

5.11 Out of Scope

We received many comments which are categorically outside the scope of the EA. Comments on topics outside the scope of the EA include nonpredator damage management, grazing, and other land management decisions.

This EA covers PDM conducted by WS-Montana within the State of Montana, as stated in 1.9.4. All other wildlife management actions, especially those conducted by other agencies, are outside the scope of the EA. This includes the following list of comments, which are outside the scope of this EA:

- Montana’s wildlife/land managers are corrupt.
- Ranchers are lazy and corrupt
- Damage management of wildlife outside scope of EA including bison and prairie dogs.
- Opposes grazing on public lands.
- Pollution
- Global climate change
- Over-fishing
- American colonization
- U.S. Fish and Wildlife Services policy/enforcement
- Wildlife management in other states or countries
- Federal training policy
- Website functionality

5.12 Clarifications based on Comments

Section 2.3.3 (pages 137-138)
Changes were made to this section to clarify that non-lethal preventive PDM would be implemented by WS-Montana under Alternative 3. The following sentence was added “Non-lethal and lethal technical assistance, as well as non-lethal preventive damage management, would continue to be used as described in Alternative 1”. Furthermore, the first requirement of the alternative was edited to read “Livestock grazing permittees and operators, landowners, and resource managers -with the assistance of WS-Montana, if desired - show evidence of sustained and ongoing use of reasonable non-lethal or husbandry techniques aimed at preventing or reducing predation prior to receiving WS-Montana assistance with lethal IPDM methods”

Section 3.5.11.3.3 (page 256)
The document inaccurately referred to a Demographic Monitoring Area for the Cabinet-Yaak Ecosystem. No such DMA exists, and the terminology was corrected to the Cabinet-Yaak recovery zone and 10-mile buffer.

Section 1.11.4.4 (page 80)
Language regarding MCA §87-6-106 was altered to clarify that state law does not allow the take of grizzly bears that are threatening to attack/kill livestock.

Section 1.11.4.4 (page 78)
The document stated that there are two distinct populations of grizzly bears in Montana, however the intent of the sentence was to describe the 2 separate grizzly bear management plans in Montana. The sentence was modified to read “There are two management plans for grizzly bears, listed as threatened under ESA, in Montana (Dood et al. 2006, Montana Fish Wildlife and Parks 2013).”

Section 3.5.5.3.1 (page 214)

The document stated that WS-Montana would take no more than 80 gray wolves per year, which did not match the maximum projected annual take used for analysis. The sentence was corrected to read "Under Alternative 1, we anticipate that WS-Montana would take no more than 100 gray wolves."

6 List of Agencies Consulted

United States Department of Interior, Bureau of Land Management

United States Department of Agriculture, Forest Service

United States Department of Interior, United States Fish and Wildlife Service

Montana Livestock Loss Board

Montana Department of Livestock

Montana Fish Wildlife & Parks

7 List of Preparers

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Appendix A. What Predator Damage Management Methods and Techniques Are Used in the Current Program?

Introduction

WS-Montana works with federal, state, local agencies, private individuals, and associations to protect livestock, poultry, natural resources, property, and human safety from wildlife threats and damages. WS-Montana conducts technical assistance (education, information, and advice) and operational wildlife damage management when requested.

Federal, state, tribal, and local regulations and APHIS-WS Directives govern APHIS-WS' use of damage management tools. The following methods and materials are recommended or used in technical assistance and operational damage management efforts of the WS-Montana program. See Section 3.9 for a detailed discussion on humaneness of various IPDM methods.

What Non-Lethal IPDM Methods Are Available to WS-Montana?

Non-lethal methods consist primarily of actions, tools, or devices used to disperse or capture a particular animal or a local population, modify habitat or animal behavior, create exclusion between predators and damage potential, and/or practicing husbandry to reduce the risk of or alleviate damage and conflicts. Most of the non-lethal methods available to WS-Montana are also available to other entities within the state and could be used by those entities to mitigate wildlife damage. Depending on the method, the cooperator and/or the WS-Montana employee may implement it. Livestock producers and property owners are encouraged by WS-Montana to use non-lethal methods to prevent damage.

Each non-lethal method described below identifies its possible application as technical assistance and/or operational assistance.

Education: Technical Assistance

Education is an important element of IPDM activities and facilitates coexistence between people and wildlife. In addition to providing recommendations and information to entities experiencing damage, APHIS-WS provides lectures, courses, and demonstrations to government agencies, universities, and the public. Technical papers are presented at professional meetings and conferences to highlight recent developments in WDM technology, programs, laws and regulations, and agency policies. APHIS' Legislative and Public Affairs (LPA) program coordinates public outreach on WDM topics. APHIS-LPA and APHIS-WS work with agency partners, tribes, universities, extension programs, and others to develop educational materials about predator concerns and methods to resolve problems.

Physical Exclusion: Technical Assistance

Physical exclusion methods can sometimes prevent predators from accessing valuable resources. Woven wire and other types of more permanent fencing, especially if it is installed with an underground skirt, can prevent many predator species that burrow, including coyotes, foxes, badgers, feral cats, and striped skunks. Areas such as airports, yards, or hay meadows may be fenced. Hardware cloth or other metal barriers can sometimes be used to prevent girdling and peeling of valuable trees or patch holes or gaps in existing structures. Entrance barricades are used to exclude bobcats, coyotes, foxes, opossums, raccoons, or skunks from dwellings, storage areas, gardens, or other areas.

Temporary fences, such as electric polytape fence or fladry fencing, are often used to protect livestock in temporary pastures, as night pens for sheep, or for protection of small pastures. These systems may need to be maintained or moved frequently to avoid malfunctions or predator habituation.

Predator-proof fencing may be effective in confined situations or for protecting extremely high-value animals. These fences are designed with sufficient height and depth to prevent predators from jumping over or digging under. The initial cost of constructing a predator-proof fence often discourages their use, but may be economically practicable in small areas, such as calving grounds and bedding areas.

Electric fences have been used effectively to reduce predator damage to crops and livestock. Bears have been dissuaded from landfills, trash dumpsters, cabins, beehives and other properties using electric fencing. However, electric fencing can be expensive and requires constant maintenance to avoid short-circuiting.

Animal Husbandry: Technical Assistance

Animal husbandry practices may minimize livestock exposure to predators. Animal husbandry includes actions such as modifications in the level of care and attention given to livestock, shifts in the timing of breeding and births, selection of less vulnerable livestock species, and introduction of human and animal custodians to protect livestock. The duration of animal husbandry techniques may range from daily to seasonal. Generally, as the frequency and intensity of livestock handling increases, so does the degree of protection, since the risk of depredation is greatest when livestock are left unattended.

Shifts in breeding schedules can reduce the risk of depredation by altering the timing of births to coincide with the greatest availability of natural prey to predators or to avoid seasonal concentrations of migrating predators. Hiring extra herders, building secure holding pens, and adjusting the timing of births may be expensive, but effective. The timing of births is often related to weather or seasonal marketing of young livestock, and therefore shifts in breeding schedules may not always be feasible.

Herders and range riders are often used by producers to monitor sheep and cattle pastures for the presence of predators. Herders and range riders employee a variety of non-lethal methods, such as carcass removal, guard dogs, propane cannons, non-lethal projectiles, and animal husbandry. Work often occurs during the day and night to effectively deter predators.

Pasture selection involves moving livestock to areas less susceptible to predation events, such as pastures near man-made structures. The risk of depredation diminishes as age and size increase and can be minimized by holding expectant females and newborn livestock in pens. Nightly gathering may not be possible where livestock are in many fenced pastures or where grazing conditions require livestock to scatter.

Behavior selection of livestock is the practice of choosing animals with nurturing or protective temperaments for breeding. Livestock that are more wary of predators or protective of their offspring help protect the herd from predation, especially when left in unattended pastures.

Guard animals, such as dogs, burros, donkeys, and llamas, can effectively reduce predation losses. Success in using guard animals is highly dependent on proper breeding and bonding with livestock, amount and type of predation loss, size and topography of the pasture, effectiveness of training, compatibility with humans. The effectiveness of guarding animals may not be sufficient in areas where there is a high density of predators to be deterred, especially territorial pack species, and where livestock are scattered. The use of Old World guarding dog breeds, such as Great Pyrenees, Kangal, and Komondor, have been effective in protecting livestock from coyote predation in the United States. Guard donkeys have been used to deter dog and coyote predation with varied success. Guard llamas readily bond with sheep and are can reduce coyote predation. All technical assistance regarding guard dogs is conducted in compliance with WS Directive 2.440 (Section 2.4.1).

Habitat Management: Technical Assistance

Predator presence is often related to the type, quality, and quantity of suitable habitat. Habitat can be managed to reduce the attraction of certain predator species. The effectiveness of habitat management to reduce predator damage is dependent on the species involved, damage type, economic feasibility, and legal constraints on protected habitat types (e.g., wetlands). In most cases, the resource or property owner is responsible for implementing habitat modifications. WS-Montana only provides advice on the type of modifications that have the best chance of achieving the desired effect. WS-Montana advises landowners/managers that they are responsible for compliance with all applicable regulations related to habitat management, including the Endangered Species Act.

Architectural design can often help to avoid potential predator damage. For example, incorporating open areas into landscape designs that expose animals may significantly reduce potential problems. Additionally, selecting species of trees and shrubs that are not attractive to wildlife can reduce the likelihood of potential predator damage to parks, public spaces, or residential areas.

Managing the habitat, such as minimizing cover, planting lure crops, and tree removal, can sometimes reduce damage associated with predators that use vegetation and crops for foraging and hiding. Habitat management is a primary strategies at airports to reduce aircraft damage and protect human safety. Generally, many problems associated with predator loafing, breeding, or feeding on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways.

Reducing food attractants near homes, buildings, and pastures can reduce predator attraction. Sources include unprotected garbage, outdoor pet food, trash cans, and bird feeders. Removal or sealing of garbage, monitoring of small pets when outdoors, and elimination of outdoor pet food can reduce attracting unwanted predators. Additionally, proper and timely disposal of livestock carcasses also reduces predator attractants.

Modifying Animal Behaviors: Technical and/or Operational Assistance

Modifying animal behaviors involves techniques aimed at causing target animals to flee or remaining at a distance. Frightening and harassment devices are one of the oldest and most popular methods of reducing wildlife damage and depend on the animal's aversion to offensive stimuli. These methods usually use extreme and random noise or harassment and should be changed frequently as wildlife usually become habituated to scare devices. Motion-activated systems may also extend the effective period for frightening devices. These techniques tend to be more effective when used in a strategy involving the use of multiple methods. However, their continued success may require reinforcement by limited lethal shooting to avoid habituation.

Electronic distress sounds and alarm calls are electronic devices that broadcast recorded or artificial wildlife distress sounds in the immediate area and are intended to cause a flight response from specific species. These sounds may be used alone or in conjunction with other scaring devices. Animals react differently to distress calls so their use depends on the species and problem. Calls may be played for short bursts, long periods, or even continually, depending on the severity of damage and relative effectiveness of different treatment or "playing" times. These calls can be used in urban areas effectively and without excessively disturbing humans. Distress and alarm calls are usually effective for short periods which can provide time to implement other solutions.

Propane exploders/cannons are attached to a propane tank and produce loud explosions (similar to a firearm discharge) at controllable intervals. They are strategically utilized in areas of high predator concentrations. Because animals habituate to the sound, exploders must be moved frequently and used in conjunction with other scare devices. Propane cannons are generally inappropriate for urban/suburban areas due to the repeated loud explosions.

Pyrotechnics have a variety of forms, including firecrackers, shell crackers, noise bombs, whistle bombs, and racket bombs, and can be timed to explode at different intervals. Shell crackers are 12-gauge shotgun shells containing a firecracker that is projected up to 75 yards before exploding. The shells should be fired so they explode in front of, or underneath, the target animals. Noise bombs, whistle bombs, and racket bombs are similar to shell crackers, but are fired from 15-millimeter flare pistols. Noise bombs travel about 75 feet before exploding. Whistle bombs are non-explosive and produce a trail of smoke and a whistling sound. Racket bombs make a screaming noise, do not explode, and can travel up to 150 yards. Use of pyrotechnics may be precluded in some areas because of noise impacts. WS-Montana employees receive safety training in transporting, using, and storing pyrotechnics, as required by WS Directives 2.615 and 2.625 (Section 2.4.1). When pyrotechnics are recommended during technical assistance, WS-Montana provides pyrotechnics safety information and instructions to the user.

Electronic Guard (siren strobe-light devices), developed by APHIS-WS NWRC, is a battery-powered unit operated by a photocell that emits a flashing strobe light and siren call at intervals throughout the night. Efficacy of strobe-sirens is highly variable and typically lasts less than three weeks, but in certain situations, has been used successfully to reduce coyote and bear depredation on sheep. The device is a short-term tool used to deter predation until livestock can be moved to another pasture, brought to market, or other IPDM methods are implemented. This technique is most successful at bedding grounds where sheep gather at night and may be used in rural or urban settings.

Visual scaring techniques such as lights, fladry, and effigies can be effective. These techniques are generally used for small, enclosed areas. Fladry, consisting of hanging flags evenly spaced along rope or fence wire, move in the wind and create a novel disturbance for predators. However, predators may become accustomed to fladry and the technique requires regular maintenance to replace the flags. Turbo fladry, similar to regular fladry, consists of colored flagging spaced evenly along a length of electrical fence. This technique reinforces the effectiveness of regular fladry with the shock deterrent of an electric fence. Fladry has been effective at protecting livestock in pastures as large as 40-acres for up to two months. It can be used as a night penning strategy.

Non-lethal projectiles, such as rubber bullets or paintballs, can be used as an aversion technique, but require continued use to avoid wildlife becoming habituated. This method requires prolonged presence and is most efficient when the landowner assists with monitoring and implementation. WS-Montana and MFWP can provide technical assistance to property owners on how to safely implement this method. Non-lethal projectiles rarely result in death or injury to wildlife due to careful shot placement and avoiding close range use.

Aerial hazing/harassment/dispersal techniques use the noise and visual presence of fixed-wing aircraft or helicopters to discourage wildlife from congregating near livestock or other resources. Aerial hazing may be used in combination with other non-lethal methods, such as non-lethal projectiles, to further discourage wildlife. Aviation safety and operations SOPs are provided in WS Directive 2.620 (Section 2.4.1) and APHIS-WS Aviation Rules (WS 2009). All efforts are conducted in strict compliance with the APHIS-WS Aviation and Safety Manual, the Federal Aviation Regulations, applicable State and local laws and regulations, Aviation Safety Plans, Aviation Communication Plans, and Aviation Emergency Response Plans.

Live-Capture and Relocation: Operational Assistance

Live-capture and relocation, when not legally prohibited by state and local law, can be used by WS-Montana personnel, per WS Directive 2.501 (Section 2.4.1). WS-Montana only relocates predators at MFWP’s direction and coordinates capture, transportation, and selection of relocation sites with MFWP. Relocating predators, other than bears and mountain lions, is prohibited under MFWP policy (Section 1.12.1). Decisions to relocate wildlife are based on biological, ecological, economic, and social factors, such as availability of suitable habitat, likelihood of increased competition or predation stress on the relocated animal, likelihood of the animal returning, public attitudes, potential conflict or damage to resources near the relocation site, and potential disease transmission.

What IPDM Methods That May be Either Lethal or Non-Lethal Are Available to WS-Montana?

WS-Montana specialists can use a variety of devices to capture predators. Methods such as cage traps, cable restraints, and trained pursuit dogs are used to non-lethally capture predators, but can be used lethally depending on the circumstance. For instance, WS-Montana can use a cage trap to capture an animal and then immobilize and relocate (non-lethal) or dispatch with a firearm (lethal), given the circumstances and applicable federal, state, and local laws and regulations.

All baits, scents, and attractants used to aid in capturing animals may consist of carcasses of game animals, furbearers, and fish, provided that the animals are not taken specifically for this purpose and that such use and possession is consistent with Federal, State, and local laws or regulations per WS Directive 2.455. APHIS-WS Policy (WS Directive 2.450, Section 2.4.1) states that the use of the BMP trapping guidelines developed by AFWA would be followed as practical. APHIS-WS policies and Montana state laws for using traps and snares are listed in Section 2.4.1 and Section 2.4.4, respectively. Most of these methods can also be used by MFWP, landowners, and their agents, as approved methods for IPDM or regulated fur trapping.

Cage/box traps are live-capture traps for capturing small mammals such as skunks, feral cats, and raccoons. Cage traps come in a variety of sizes and are generally made of galvanized wire mesh, metal, plastic, or wood, and consist of a treadle inside the baited cage that triggers the door to close behind the animal being captured, preventing exit. Cage traps can range in size from small traps intended for the capture of smaller mammals to large corral/panel traps fitted with a routing or saloon-style repeating door, used to live-capture larger animals. Cage traps are species selective based on trap size which can physically exclude non-target animals. Traps are sometimes baited or set near signs of damage, known travel areas, or wildlife entrances to buildings or dens. Non-target animals are generally released with little or no injury. An adequate supply of food and water is placed in the trap to sustain captured animals for several days, but traps are typically checked on a daily basis. Cage traps are available to all entities to alleviate damage and can be purchased commercially.

Culvert traps are a type of large, baited, live-capture cage trap for large mammals. These traps have trigger systems attached to gravity doors, and are constructed of solid sheet metal on a wheeled platform or trailer. APHIS-WS most often uses this type of trap for bears in urban/suburban settings, but culvert traps can also be used in rural areas and for other species. APHIS-WS implements a daily trap check for all culvert traps. Non-target animals are generally released with little or no injury and target bears are either euthanized or relocated as appropriate and when authorized by MFWP.

Quick-Kill/Body Gripping Traps are used by APHIS-WS to capture various mammals, such as raccoons, skunks, red foxes, and badgers. The body-gripping trap is lightweight and consists of a pair of rectangular wire frames that close when triggered, killing the captured animal with a quick blow. Smaller-sized traps may also be set in the entrance of a wooden box or other structure with bait. Quick-kill traps set for predators are primarily used in rural areas, limiting non-target animal trap exposure. Quick-kill traps are lethal to both target and non-target animals. WS Directive 2.450 prohibits the use of body-gripping traps with a jaw spread exceeding 8 inches for land sets.

Foothold traps can be used for live-capture and release or hold for subsequent euthanasia. They are made of steel with springs that close the jaws of the trap around the foot of the target species. They are versatile for capturing small to large-sized predators. These traps usually permit the release of non-target animals unharmed. Foothold traps may have offset steel or padded jaws, which hold the animal while reducing the risk of injury. The padded foothold trap can be unreliable in rain, snow, or freezing weather.

Traps are placed in the travel paths of target animals and some are baited or scented, using an olfactory attractant, such as the species' preferred food, urine, or musk/gland oils. Use of baits also facilitates prompt capture of target predators by decreasing the total time traps are used, thereby lowering risks to non-target animals. In some situations a draw station, a carcass or large piece of meat, is used to attract target animals. In this approach, one or more traps are placed in the vicinity of the draw station. APHIS-WS program policy prohibits placement of traps closer than 30 feet to the draw station to reduce the risk to non-target animals (APHIS-WS Directive 2.450, Section 2.4.1).

Foothold traps set for coyotes, red foxes, bobcats, and similarly-sized predators are set with dirt or debris (e.g., leaf litter or rotting wood) sifted on top. The traps can be staked to the ground securely, attached to a solid structure (such as a tree trunk or heavy fence post), or used with a drag that becomes entangled in brush to prevent trapped animals from escaping. Anchoring systems should provide enough resistance that a larger animal that is unintentionally captured should be able to either pull free from the trap or be held to prevent escaping with the trap on its foot.

Effective trap placement also contributes to trap selectivity. To minimize risk of capturing non-target animals, the user must be experienced and consider the target species' behavior, habitat, environmental conditions, and habits of non-target animals. The pan tension, type of set, and attractant used greatly influences both capture efficiency and risks of catching non-target animals. The level of trap success is often determined by the training, skill, and experience of the user to adapt the trap's use for specific conditions and species. When determining how often to check traps, the user must balance the need for avoiding unnecessary disturbance of the trap area and humaneness of trapping to the captured animals. WS-Montana follows state law and regulations regarding the setting and checking of traps and snares as follows per APHIS-WS Directive 2.450 and 2.210 (Section 2.4.1).

Dog-proof/enclosed foothold traps are designed for particular species, such as raccoons, which use their foot to reach into small, enclosed spaces to gain access to bait. These traps are baited or scented, using an olfactory attractant, such as the species' preferred food, to attract the animal. When an animal reaches into the trap and pulls on the baited lever, a spring quickly closes the trap around the animal's foot. The traps are often made of rounded plastic or metal, which holds the animal while reducing the risk of harm. The dog-proof foothold trap can be set under a wide variety of conditions but can be unreliable in rain, snow, or freezing weather. The traps are either staked to the ground securely or attached to a solid structure (such as a tree trunk or heavy fence post).

The dog-proof foothold trap minimizes unintentional capture due to the species-selective attractants, enclosed space that physically prevents larger species from being captured, and the behavioral differences between species by requiring the animal to put their foot into the trap to access the bait. These traps usually permit the release of unintentionally captured animals unharmed.

WS-Montana follows the laws and regulations regarding the setting and checking of traps and snares as follows per APHIS-WS Directive 2.450 and 2.210 (Section 2.4.1).

Cable restraints (foot snares and neck/body snares) can be used for live-capture and release, for holding for subsequent euthanasia, or for a direct kill, depending on how and where they are set. They are traps made of strong, lightweight cable, wire, or monofilament line with a locking device, and are used to catch small- and medium-sized predators by the neck, body, or foot. Snares can be used effectively on animal travel corridors, such as under fences or trails through vegetation.

When an animal steps into the cable loop place horizontally on the ground, a spring is triggered, and the cable tightens around the foot to hold the animal. If the snare is placed vertically, the animal walks into the snare and the neck or body is captured or entangled. On standard cable snares, snare locks are typically used to prevent the loop from opening again once the loop has closed around an animal. Loop stops can also be incorporated to prevent the loop from either opening or closing beyond a minimum or maximum loop circumference, which can effectively excluding non-target animals or allow for live-captures of target animals.

Cable devices are also equipped with a swivel to minimize injuries to the captured animal and reduce twisting and breakage of the snare cable. Breakaway devices can also be incorporated into snares, allowing the loop to break open and release the animal when a specific amount of force is applied. These devices can improve the selectivity of cable restraints to reduce non-target species capture, however only when the non-target species is capable of exerting a greater force to break the loop than the target species.

The Collarum™ is a non-lethal, spring-powered, modified neck snare device that is primarily used to capture coyotes and foxes. It is activated when an animal bites and pulls a cap with a lure attractive to coyotes, whereby the snare is projected from the ground up and over the head of the coyote or fox. As with other types of snares, the use of the Collarum™ device to capture coyotes is greatly dependent upon finding a location where coyotes frequently travel where the device can be set. A stop on the device limits loop closure. The trigger is designed specifically for canines, which use a distinct pulling motion to set off the device.

In general, cable restraints are available to all entities to alleviate damage within state law. Snares offer several advantages over foothold traps by being lighter to transport or carry and not being as affected by inclement weather.

Trap monitors are devices that send a radio signal to a receiver if a set trap is disturbed, alerting field personnel that an animal may be captured. Trap monitors can be attached directly to the trap or attached to a wire and placed away from the trap. When the monitor is hung above the ground, it can be transmit a signal for several miles, depending on the terrain. There are many benefits to using trap monitors, such as saving considerable time when checking traps, decreasing fuel usage, prioritizing trap checks, and decreasing the need for human presence in the area. By using trap monitors to prioritize trap checks, the amount of time a captured animal is restrained is decreased, minimizing pain and stress and allowing non-target animals to be released in a timely manner.

APHIS-WS continues to review trap monitoring systems that are commercially available (USDA 2007, 2013), but modern trap monitors are not sufficiently reliable due to variable terrain, poor signal reception, and rudimentary monitor technologies. Newer technologies, such as cell phone text messages, rely on cell reception to transmit signals which is not always available in rural areas. WS-Montana continues to look for opportunities to test current and developing systems.

Catch poles consist of a long pole with a cable noose at one end. They can be used for live-capture and release, relocation, or subsequent euthanasia. The noose end is typically encased in plastic tubing to protect the neck of the animal. Catch poles can be used to safely catch and restrain animals such as bear cubs, feral cats, feral dogs, and raccoons.

Hand nets are used to catch small mammals in confined areas, such as buildings. They can be used for live-capture and release, relocation, or subsequent euthanasia. These nets resemble fishing dip nets, but are larger and have long handles.

Net guns and launchers are devices that project a net over a target animal using a specialized gun and are normally used for animals that do not avoid people. They can be used for live-capture and release, or for holding for subsequent euthanasia. They require mortar projectiles or compressed air to propel a net up and over animals that have been baited to a particular site. Net guns are manually discharged, while net launchers are discharged by remote from a nearby observation site. Net guns can be used in rural and urban situations and discharged from the ground, helicopter, or vehicle. Net guns are an animal-specific, live-capture technique, with target animals typically released unharmed.

Dart guns are non-lethal capture devices (specially-designed rifles) that fire darts filled with tranquilizer. Once tranquilized, the animal may be handled safely for research or relocation purposes, or subsequently euthanized. Use of dart guns are species-selective, as field personnel positively identify the species before tranquilizing the animal. Dart guns are generally limited in range to less than 120 feet. If other factors preclude setting of equipment or the use of firearms, such as proximity to urban or residential areas, dart guns may be the only option available. Chemical capture methods require specialized training and skill, and are limited to WS-Montana and other certified entities.

Trained pursuit dogs are used by APHIS-WS (per state law) for coyote, mountain lion, and black bear damage management activities on both private and public lands, typically in rural settings. Pursuit dogs are trained to follow the scent of the target species and can be used to find coyote dens, decoy coyotes, and pursue problem bears and mountain lions. Once the target animal is located by the pursuit dogs, field personnel use dart guns or firearms to euthanize the animal or immobilize for release. Pursuit dogs are always accompanied by field personnel and are redirected if found to be following the tracks or scent of non-target animals. Trained dogs are especially effective at indicating where predators have traveled, urinated, or defecated, which may be useful for setting cable restraints or traps and increase the certainty of capturing the target species.

Per WS Directive 2.445 (Section 2.4.1), the dogs are not allowed to have any physical contact with the animal either before or after capture. Individual dogs that cannot be restrained from physical contact with wildlife or continue to follow non-target scents are discontinued from use. All dogs shall have a safe and insulated transport box, food, water, medical care, and be licensed and vaccinated. State law regarding use of pursuit dogs is found at Section 2.4.4.2.

What Lethal IPDM Methods Are Available to WS-Montana?

Aerial Shooting: Technical Assistance or Operational Assistance

Aircraft, both fixed-wing and rotary-wing (helicopters), are used by WS-Montana for removing predators. The most frequent aircraft used for aerial shooting and harassment is the fixed-wing aircraft Piper PA-18 Super Cub and CubCrafters CC-18 Top Cub and rotary-wing Hughes MD500 and Bell OH-58. WS-Montana conducts aerial activities on areas only under signed agreement or federal Annual Work Plans, and concentrates efforts to specific areas during certain times of the year. During technical assistance, WS-Montana may advise cooperators to hire private operators with an MDOL permit for aerial shooting. Additionally, WS-Montana may conduct the work operationally at the request of cooperators.

Aerial shooting consists of visually sighting target animals in the problem area and shooting them with a firearm from an aircraft. Aerial shooting is species-specific and can be used for immediate damage relief, providing that weather, topography and ground cover conditions are favorable. Aerial shooting can be effective in removing offending animals that have become trap-shy or are not susceptible to calling and shooting or other methods. This method may also be used proactively to reduce local coyote predations in lambing and calving areas with a history of predation.

Fixed-wing aircraft are useful for aerial shooting over flat and gently rolling terrain. Because of their maneuverability, helicopters have greater utility and are safer over timbered areas or broken land where animals are more difficult to spot. Aerial shooting typically occurs in remote areas with low densities of tree or vegetation cover, where the aerial visibility of target animals is greatest. WS-Montana spends relatively little time flying and shooting over any one area.

The APHIS-WS program aircraft-use policy (WS Directive 2.620, Section 2.4.1) and APHIS-WS Aviation Rules (WS 2008) help ensure that aerial shooting is conducted in a safe and environmentally sound manner, in accordance with federal and state laws. State Directors and Program Managers are responsible for the supervision, management, and compliance for all aviation activities within the state, and all aircraft used by WS-Montana activities through contract, agreement, or volunteer, shall have been approved by the office of the APHIS-WS National Aviation Coordinator (NAC). WS Directive 2.615 (Section 2.4.1) guides all APHIS-WS shooting activities. All efforts are conducted in strict compliance with the APHIS-WS Aviation and Safety Manual, the Federal Aviation Regulations, the Fish and Wildlife Act of 1956 (Airborne Hunting), any applicable State and local laws and regulations, individual WS-Montana and APHIS-WS NWRC program Aviation Safety Plan, Aviation Communication Plans, and Aviation Emergency Response Plans.

The APHIS-WS Aviation Training and Operations Center (ATOC) located in Cedar City, Utah, mission is to improve aerial operations safety and provide training and guidance for APHIS-WS aviation personnel and aerial activities. The policy and primary focus of APHIS-WS and contract aviation personnel is ensuring the well-being through safety and accident prevention efforts. Pilots and aircraft must be certified under established APHIS-WS program procedures. Only properly trained APHIS-WS program employees are approved as crewmembers. Ground crews are often used with aerial operations for safety and for providing assistance with locating and recovering target animals.

Ground Shooting: Technical or Operational Assistance

WS-Montana personnel may either provide advice regarding ground shooting for predators as part of technical assistance or provide the service themselves. Ground shooting with firearms is highly-selective for target species. Shooting can be selective for offending individuals and has the advantage that it can be directed at specific damage situations. The majority of shooting occurs in rural areas on both private and public lands, as well as airports for health and human safety. Shooting is sometimes used as one of the first lethal damage management options because it offers the potential of resolving a problem quickly and selectively. Shooting is limited to locations where it is legal and safe to discharge a firearm.

Calling and shooting is a technique which uses hand-held manual or electronic devices that broadcast recorded or artificial wildlife sounds in the immediate area and are intended to draw specific species to an area where they can be lethally removed with a firearm. Animals react differently to these calls so their use depends on the species and problem. Calls are often played for short bursts and cause minimal disturbance.

A handgun, shotgun, air gun, or rifle may be utilized. In addition, a spotlights, night vision, thermal imagery for night shooting, decoy dogs, predator calling, stalking, and/or baiting may be used to increase ground shooting efficiency and selectiveness. Spotlights are often covered with a red lens which nocturnal animals may not be able to see, making it easier to locate them undisturbed. Night shooting may be conducted in sensitive areas that have high public use or other activity during the day, which would make daytime shooting unsafe. The use of night vision and Forward Looking Infrared (FLIR) devices can also be used to detect and shoot predators at night. Coyotes and red foxes that may be trap-wise and therefore difficult to trap, are often responsive to simulated predator calling.

To ensure safe use and awareness, APHIS-WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within three months of their appointment and a refresher course annually thereafter (WS Directive 2.615, Section 2.4.1). The use and possession of firearms must be in accordance with federal, state, and local laws and regulations (also WS Directive 2.210, Section 2.4.1). APHIS-WS personnel must adhere to all safety standards of firearm operation as described in the APHIS-WS Firearms Safety Training Manual. Such personnel are subject to drug testing when considered for hire, randomly, when under reasonable suspicion, and after accidents have occurred. All employees who use firearms are subject to the Lautenburg Domestic Confiscation Law, which prohibits firearm possession by anyone convicted of a misdemeanor crime or domestic violence. WS-

Montana complies with state laws, statutes, and MFWP authorized methods for ground shooting.

While on duty, APHIS-WS employees are authorized to store, transport, carry, and use only the firearms necessary to perform official APHIS-WS duties. The maximum type of security available must be used to secure firearms when not directly in use and to ensure that unauthorized access is prevented. No firearms shall be left unattended unless securely stored. Authorization is required for leaving firearms stored in vehicles overnight. Ammunition, pyrotechnic pistols, net guns, dart guns, air rifles, and arrow guns will be stored securely unloaded as determined by the State Director.

MFWP, commercial operators, and landowners/resource owners can also use ground shooting for IPDM, in compliance with state laws and regulations.

Carcass Disposal: Technical Assistance or Operational Assistance

Carcass disposal methods are dependent on the species. WS-Montana disposes of carcasses according to WS Directives 2.515 and 2.510 (Section 2.4.1) and Montana state law and regulations. Predator carcasses are disposed of in approved carcass disposal sites on public or private lands or on-site where captured. WS-Montana does not bury predator carcasses.

What Lethal and Non-lethal Chemical Methods are Available to WS-Montana?

Chemical Repellents (Non-lethal): Technical and Operational Assistance

Chemical repellents are usually naturally-occurring substances or formulated chemicals that are distasteful or to elicit temporary pain or discomfort for target animals when they are smelled, tasted, or contacted. Effective and practical chemical repellents should be non-toxic to target predators, other wildlife, plants, and humans; resistant to weathering; easily applied; and highly effective.

The reaction of different animals to a particular chemical varies, and for many species there may be variations in repellency between different habitat types. Effectiveness depends on the resource to be protected, time and length of application, and sensitivity of the species causing damage. Repellents are not available for many species that may cause damage problems. Chemicals are not used by WS-Montana on public or private lands without authorization from the land management agency or property owner or manager.

Chemical Fumigants (Lethal): Operational Assistance

Denning is the practice of locating coyote, fox, and skunk dens and killing the young and/or adults by using a registered gas fumigant cartridge. This method used to manage present depredation of livestock by coyotes, fox, and skunks or anticipated depredation from coyotes. When the adults are killed and the den site is known, denning is used to euthanize the pups and prevent their starvation (See Section 3.9.5.2.2 of this EA). Denning is highly selective for the target species responsible for damage. Den hunting for coyotes and red foxes is often combined with other damage management activities such as aerial shooting and ground shooting.

Gas cartridges are normally applied in rural settings on both private and public lands. When dens are selected for fumigation, the fuse of the gas cartridge is ignited and hand-placed at least three to four feet inside in the active den. Soil is then placed in the den entrance to form a seal to prevent the carbon monoxide from escaping and oxygen entering. Sodium nitrate is the principal active chemical in gas cartridges and is a naturally-occurring substance. When ignited, the cartridge burns in the den, depleting the oxygen and producing large amounts of carbon monoxide, a colorless, odorless, tasteless, poisonous gas.

Use of gas cartridges may pose a risk to non-target animals that may also be found in burrows of target predators. Given the omnivorous nature of target predator diets, non-target rodents, reptiles or amphibians are highly unlikely to occur in a coyote or fox den. WS-Montana conducts pretreatment site surveys to identify signs of use by non-target species (such as tracks or droppings).

All animals removed by denning are humanely euthanized per WS Directives 2.425 "Denning" and 2.505 "Lethal Control of Animals" (Section 2.4.1). The gas cartridges used for denning (EPA Reg. No. 56228-21, EPA Reg. No. 56228-2) are registered by WS-Montana with MDA. All pesticides used by WS-Montana are registered under the FIFRA and administered by EPA and MDA. All WS-Montana personnel who apply restricted-use pesticides are state-certified pesticide applicators and have specific training by WS-Montana for pesticide application per WS Directive 2.465 (Section 2.4.1).

What Tranquilizer and Immobilization Methods are Available to WS-Montana?

Tranquilizer and immobilization chemicals may be used by WS-Montana to aid in the humane handling of predators to avoid injury to the handler and the predator. Immobilization agents can eliminate pain and reduce stress of animals while being handled. Immobilizing agents are delivered to the target animal with a dart gun or syringe pole, depending on the circumstances and the species being immobilized. WS-Montana field personnel may use immobilization drugs to safely release unintentionally captured animals. Immobilizing drugs may also be used to safely release animals after collecting biological samples for disease surveillance or research studies.

When administering tranquilizer or immobilization chemicals to any animal, field personnel must consider the animal's physical condition, size, age, and health. WS Directive 2.430 (Section 2.4.1) provides detailed training and certification requirements for APHIS-WS personnel administering immobilization drugs. The following immobilization chemicals are under the jurisdiction of the United States Food and Drug Administration (FDA) and/or DEA.

Ketamine (Ketamine HCl; Ketaset™) is a rapid acting, non-narcotic, non-barbiturate injectable anesthetic agent that immobilizes the animal and prevents the ability to feel pain (analgesia). The drug produces a state of dissociative unconsciousness, which does not affect the reflexes needed to sustain life, such as breathing, coughing, and swallowing. Ketamine is possibly the most versatile drug for chemical capture and has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Ketamine is often combined with other drugs, such as Xylazine, maximizing the reduction of stress and pain and increasing human and animal safety during handling. Following administration of recommended doses, animals become immobilized in about 5 minutes, with anesthesia lasting from 30 to 45 minutes. Depending on dosage, recovery may be as quick as four to five hours or may take as long as 24 hours. Recovery is generally smooth and uneventful.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with Ketamine HCl to produce a relaxed anesthesia. This combination can reduce heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions. Xylazine can also be used alone to facilitate physical restraint. Because Xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel must minimize sight, sound, and touch to minimize the animal stress. Recommended dosages are administered through intramuscular injection, allowing the animal to become immobilized in about 5 minutes and lasting from 30 to 45 minutes. Yohimbine is a useful drug for reversing the effects of Xylazine.

Capture-All 5™ is a combination of Ketaset™ and Xylazine, and is regulated by the FDA as an investigational new animal drug. The drug is available through licensed veterinarians to individuals sufficiently trained in the use of immobilization agents. Capture-All 5™ is administered by intramuscular injection; it requires no mixing, and has a relatively long shelf life without refrigeration, all of which make it ideal for the sedation of various species.

Telazol™ is a combination of equal parts of tiletamine hydrochloride and zolazepam hydrochloride, and is a powerful anesthetic for larger animals, such as bears, coyotes, and mountain lions (Fowler and Miller 1999). Telazol™ produces dissociative unconsciousness, which does not affect the reflexes needed to sustain life, such as breathing, coughing, and swallowing. Following a deep intramuscular injection of Telazol™, onset of anesthetic effect usually occurs within 5 to 12 minutes. Muscle relaxation is optimum for about the first 20 to 25 minutes after administration, and then diminishes. Recovery varies with the age and physical condition of the animal and the dose of Telazol™ administered, but usually requires several hours. Although the combination of Ketamine HCl and Xylazine are effective, WS-Montana prefers to use Telazol™ for most of the species that are immobilized.

What Euthanasia Methods are Available to WS-Montana?

During IPDM activities, most captured animals are euthanized since predators rarely are permitted to be immobilized and relocated (Section 1.12.1). Euthanasia methods can include physical and chemical methods. Euthanasia techniques should result in rapid unconsciousness, quickly followed by death, in order to minimize stress, anxiety, and pain to the animal. In urban and suburban locations, chemical techniques can be more appropriate for euthanizing wildlife than shooting.

APHIS-WS personnel will exhibit a high level of respect and professionalism when taking an animal's life, regardless of method (WS Directive 2.505, Section 2.4.1). Only properly trained APHIS-WS personnel are certified to possess and use approved immobilization and euthanizing drugs. All acquisition, storage, and use of such drugs will be in compliance with applicable program, Federal, state, and local laws and regulations.

The following chemical and gas methods are limited to WS-Montana operational assistance. Physical euthanasia methods can be used by landowners in accordance with applicable laws and regulations, and can be recommended during technical assistance.

Chemical and Gas Euthanasia Methods (Lethal): Operational Assistance

Depending on the species, the following euthanizing drugs and gases (AVMA 2020) can be used by WS-Montana and are under the jurisdiction of FDA and/or DEA. WS-Montana personnel are trained and certified to use, record, and store euthanizing drugs in accordance with DEA and state regulations.

Sodium pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. Barbiturates are a recommended euthanasia drug for free-ranging wildlife (AVMA 2020). Sodium pentobarbital would only be administered after target animals were live-captured and properly immobilized to allow for direct injection. All animals euthanized using sodium pentobarbital and its dilutions (such as Beuthanasia-D™ and Fatal-Plus™) are disposed of at approved carcass disposal sites.

> **Beuthanasia®-D and Euthasol®** contain two active ingredients (sodium phenytoin and sodium pentobarbital) which are chemically compatible but pharmacologically different. When administered intravenously, sodium pentobarbital produces rapid anesthetic action followed by a smooth and rapid onset of unconsciousness. When administered intravenously, sodium phenytoin produces toxic signs of cardiovascular collapse and/or central nervous system depression, and hypotension can occur when the drug is administered rapidly. Sodium phenytoin exerts its effects during the deep anesthesia stage caused by sodium pentobarbital. Sodium phenytoin hastens the stoppage of electrical activity in the heart, causing a cerebral death in conjunction with and prior to respiratory arrest and circulatory collapse. This sequence of events leads to a humane, painless and rapid euthanasia (Schering-Plough Animal Health 1999). Beuthanasia®-D and Euthasol® are regulated by the DEA and the FDA for rapid and painless euthanasia of dogs, but legally may be used on other animals if the animal is not intended for human consumption (WS Directive 2.430, Section 2.4.1).
>
> **Fatal-Plus®** combines sodium pentobarbital with other substances to hasten cardiac arrest. Intravenous use is the preferred route of injection, however intra-cardiac injection is acceptable as part of the two-step procedure used by WS-Montana. Animals are first anesthetized and sedated using a combination of Ketamine/Xylazine and, once completely unresponsive to stimuli and thoroughly sedated, Fatal-Plus® is administered.

Potassium chloride, a common laboratory salt, is intravenously injected as a euthanizing agent after an animal has been anesthetized (WS Directive 2.430, Section 2.4.1).

Carbon dioxide (CO_2) gas is a colorless, odorless, non-combustible gas approved by the AVMA as a euthanasia method. CO_2 is a common euthanasia agent because of its ease of use, safety, and ability to euthanize many animals in a short time span. The advantages for using CO_2 are: 1) the rapid depressant, analgesic, and anesthetic effects of CO_2 are well established, 2) CO_2 is readily available and can be purchased in compressed gas cylinders, 3) CO_2 is inexpensive, non-flammable, non-explosive, and poses minimal hazard to personnel when used with properly designed equipment, and 4) CO_2 does not result in accumulation of tissue residues. Inhalation of CO_2 at a concentration of 7.5% increases the pain threshold and higher concentrations of CO_2 have a rapid anesthetic effect.

WS-Montana uses CO_2 to euthanize wildlife which have been captured in cage traps, by hand, or by chemical immobilization. Live animals are placed in a container and CO_2 gas from a cylinder is released into the container. The animals quickly expire after inhaling the gas. This method of euthanasia is appropriate for small predators, such as skunks and raccoons, and could be effective in urban/suburban areas where use of a firearm is not appropriate.

Physical Euthanasia Methods: Technical or Operational Assistance

Shooting is a humane field method of euthanasia when conducted by experienced personnel. A gunshot is placed between the ears to damage brain tissue, resulting in instantaneous death. Shooting may be the quickest and only method available under most field conditions and should be performed discretely by properly trained personnel (AVMA 2020).

What Chemical Pesticide Methods are Available to WS-Montana?

Pesticides have been developed to reduce wildlife damage and are used because of their efficiency. The use of many pesticides may be hazardous unless used with care by knowledgeable, trained, and state-certified field personnel. The proper placement, size, type of bait, and time of year are keys to selectivity and successful use. Most chemicals are aimed at a specific target species.

Sodium cyanide and DRC-1339 are the only registered pesticides available for IPDM in Montana (EPA Reg. No. 56228-15) and (EPA. Reg. Nos. 56228-29 and 56228-63) respectively. DRC-1339 can only be used by certified WS-Montana personnel, and therefore is only available during operational assistance. In Montana, M-44 devices (sodium cyanide) may be used by licensed pesticide applicators operating under a permit from MDA. The label for M-44 use by private individuals differs from the label used by WS applicators.

The use of M-44s for IPDM activities occur in rural settings on both private and public properties. Use of M-44s on private, public, or sovereign tribal lands in Montana must be agreed upon by the landowner or federal, state, or tribal land management agency.

Sodium cyanide is the active ingredient in the M-44, a spring-activated ejector device developed specifically for lethal removal of coyotes, and, to a substantially lesser degree, other canine predators. The M-44 device consists of a capsule holder wrapped with fur, cloth, or wool; a capsule containing 0.8 gram of powdered sodium cyanide; an ejector mechanism; and a 5- to 7-inch hollow stake. The hollow stake is driven into the ground, the ejector unit is set and placed in the stake, and the capsule holder containing the cyanide capsule is screwed onto the ejector unit. A rotten meat bait is spread on the capsule holder.

An animal attracted by the bait will try to pick up or pull the baited capsule holder. When the M-44 is pulled, a spring-activated plunger propels sodium cyanide directly into the animal's mouth. Generally, death from respiratory arrest is immediate. The M-44 is generally selective for canids because of the attractants used and their feeding behavior. When properly used, the M-44 presents little risk to humans and the environment and provides an additional tool to reduce predator damage.

Sodium cyanide is highly toxic to all species, including humans. WS-Montana personnel that use the M-44 must be certified by the MDA since it is a restricted-use pesticide. WS-Montana personnel always follow the EPA's label of 26 use restrictions and WS Directives 2.401 and 2.415 (Section 2.4.1). Per the EPA registration label, M-44 devices may only be used for control of coyotes, red foxes, gray foxes, and wild dogs that are vectors of communicable diseases or suspected of preying on livestock, poultry, and/or federally-listed T&E species.

In response to petition from an environmental advocacy organization, the EPA completed a review of complaints concerning risks to non-target species (including T&E species), environmental contamination, and human health and safety risks regarding use of sodium cyanide (EPA 2009). Based on the review and updated use restrictions, the EPA determined that use of M-44s are in accordance with label requirements. EPA determined that the revised APHIS-WS pesticide accounting and storage practices do not pose unreasonable risks to the environment.

DRC-1339, 3-chloro-4-methylbenenamine hydrochloride, is an avian pesticide registered with EPA. For more than 30 years, DRC-1339 has proven to be an effective method of starling, blackbird, gull, crow, raven, magpie, and pigeon damage management (West et al. 1967, West and Besser 1976, DeCino et al. 1966). DRC-1339 is a slow acting avicide that is rapidly metabolized into nontoxic metabolites and excreted after ingestion. This chemical is one of the most extensively studied and evaluated pesticides ever developed. Because of its rapid metabolism, DRC-1339 poses little risk of secondary poisoning to non-target animals, including avian scavengers (Cunningham et al. 1979, Schafer 1984, Knittle et al. 1990). This compound is also unique because of its relatively high toxicity to many pest birds, but low-to-moderate toxicity to most raptors with almost no toxicity to mammals (DeCino et al. 1966, Palmore 1978, Schafer 1981). For example, starlings, a highly sensitive species, require a dose of only 0.3 mg/ bird to cause death (Royall et al. 1967); many other bird species such as raptors, House Sparrows, and eagles are classified as non-sensitive requiring a much higher dose (Oral LD50s doses for Golden Eagles = 450 mg, Northern Harrier = 45 mg, and House Sparrow = 99 mg), usually at least a 10-fold increase in dose over sensitive species. Numerous studies have shown that DRC-1339 poses minimal risk of primary poisoning to non-target and T&E species. Secondary poisoning has not been observed with DRC-1339 treated baits. During research studies, carcasses of birds which died from DRC-1339 were fed to raptors and scavenger mammals for 30 to 200 days with no symptoms of secondary poisoning observed (Cunningham et al. 1979). This can be attributed to relatively low toxicity to species that might scavenge on birds killed by DRC-1339 and its tendency to be almost completely metabolized in target birds leaving little residue for scavengers to ingest. Secondary hazards of DRC-1339 are almost non-existent. DRC-1339 acts in a humane manner producing a quiet, painless death. Prior to the application of DRC-1339, pre-baiting is required to monitor for non-target species that may consume the bait. If non-target species are observed, then the use of DRC-1339 would be postponed or not applied. Research studies and field observations suggest that DRC-1339 treatments kill about 75% of the blackbirds and starlings at treated feedlots (Besser et al. 1968). The inherent safety features of DRC-1339 help avoid negative impacts to T&E species as well as preclude hazards to most species other than the target species listed.

DRC-1339 is unstable in the environment and degrades rapidly when exposed to sunlight, heat, or ultra violet radiation. DRC-1339 is highly soluble in water but does not hydrolyze and degradation occurs rapidly in water. DRC-1339 tightly binds to soil and has low mobility. The half-life is about 25 hours, which means it is nearly 100% broken down within a week, and identified metabolites (i.e., degradation chemicals) have low toxicity. Aquatic and invertebrate toxicity is low.

DRC-1339 concentrate is used effectively under two EPA registered labels to reduce damage by specific bird species. Hard-boiled eggs and meat baits are injected with DRC-1339 and used to reduce raven, crow, and magpie damage for the protection of newborn livestock, the young or eggs of threatened, endangered, or sensitive species, human health and safety, and silage and fodder bags. The Bird Control label is registered for application on baits to reduce damage caused by blackbirds and starlings at livestock and poultry feedlots, to be used at blackbird and starling staging areas associated with nighttime roosts with similar baits, to be used on whole kernel corn to reduce health, nuisance, or economic problems caused by pigeons in and around structures in non-crop areas, and on bread cube baits to reduce damage caused by several species of gulls that, during their breeding season, prey on other colonially nesting bird species, or damage property and crops. The specified gull species can be managed to reduce damage or damage threats on their breeding grounds or several other areas including airports and landfills and for T&E species and human health and safety protection.

The use of DRC-1339 as per label instructions will have little effect on non-target species in Montana. DRC-1339 baits cannot be used in areas where potential consumption of treated baits by T&E species could occur. Observation of sites to be treated with or without prebaiting is necessary to determine the presence of non-target species. DRC-1339 baits cannot be used directly in water or areas where runoff is likely.

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Appendix B. Federal Laws and Executive Orders Relevant to WS-Montana Actions

Federal Laws

For relevant state laws, see Section 2.4.4 of this EA.

National Environmental Policy Act (NEPA)

Most federal actions are subject to the NEPA (Public Law 9-190, 42 USC 4321 et seq.). When APHIS-WS enters into an agreement to assist another federal agency to manage wildlife damage hazards, the other federal agency must also comply with NEPA. APHIS-WS policy is to work together for compliance. NEPA requires federal agencies to incorporate environmental planning into federal agency actions and decision-making processes. The two primary objectives of the NEPA are: 1) agencies must have available and fully consider detailed information regarding environmental effects of federal actions and 2) agencies must make information regarding environmental effects available to interested persons and agencies before decisions are made and before actions are taken.

APHIS-WS complies with CEQ regulations implementing the NEPA (40 CFR 1500 - 1508) along with USDA (7 CFR 1b) and APHIS Implementing Guidelines (7 CFR 372) as part of the decision-making process. Pursuant to the NEPA and CEQ regulations, WS NEPA documents the analyses resulting from proposed federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions. NEPA documents are prepared by integrating as many of the natural and social sciences as relevant to the decisions, based on the potential effects of the proposed actions. The direct, indirect, and cumulative impacts of the proposed action are analyzed.

Pursuant to the NEPA and CEQ regulations, WS NEPA documents the analyses resulting from proposed federal actions, informs decision-makers and the public of reasonable alternatives capable of avoiding or minimizing adverse impacts, and serves as a decision-aiding mechanism to ensure that the policies and goals of the NEPA are infused into federal agency actions.

Endangered Species Act

Under the ESA (16 United States Code (U.S.C.) 1531 et seq., Endangered Species Act (ESA) of 1973, as amended; 16 U.S.C. 703-712), all federal agencies will seek to conserve threatened and endangered species and will utilize their authorities in furtherance of the purposes of the Act (Sec. 2(c)). WS conducts Section 7 consultations with the United States Fish and Wildlife Service (USFWS) to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency…is not likely to jeopardize the continued existence of any endangered or threatened species…Each agency will use the best scientific and commercial data available" (Sec.7 (a)(2)). Depending on the species, the US Fish and Wildlife Service (USFWS) and the NOAA National Marine Fisheries Service (NMFS) are charged with implementation and enforcement of the Endangered Species Act of 1973, as amended and with developing recovery plans for listed species. Under the authority of the ESA, the USFWS acts to prevent the extinction of plant and animal species. It does this by identifying species at risk of extinction, designating ("listing") these species as threatened or endangered, providing protection for these species and their habitats, developing and implementing recovery plans to improve their status, and ultimately "delisting" these species and returning full management authority to the states and tribes. While a species is listed, most management authority for the species rests with the USFWS/NMFS. However, the agencies continue to work with other Federal agencies, states, and tribes along with private landowners to protect and recover the species. The USFWS helps ensure protection of listed species through consultations (section 7 of the ESA) with other Federal agencies. Under section 10 of the ESA, the USFWS also issues permits which provide exceptions to the prohibitions established by other parts of the Act. These permits provide for conducting various activities including scientific research, enhancement of propagation or survival, and incidental take while minimizing potential harm to the species. For species federally classified as threatened, the USFWS may also issue 4(d) rules which may allow for greater management flexibility for the species. The USFWS also issues grants for protection and enhancement of habitat and for research intended to improve the status of a listed species.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and Amendments

FIFRA is the primary act under which the registration of pesticides is regulated. FIFRA authorizes Federal agencies to regulate the distribution, sale, and use of pesticides to protect human health and the environment. FIFRA authorizes EPA to review and register pesticides for specified uses. EPA also has the authority to suspend or cancel the registration of a pesticide if subsequent information shows that the continued use would pose unreasonable risks.

All pesticides distributed or sold in the United States must first be registered by EPA, and then within the individual State where it is being distributed, sold, or used. The EPA registration process requires that pesticides will be properly labeled and that, if used in accordance with the label, the pesticide should not cause unreasonable harm to humans or the environment. FIFRA does not fully preempt state, tribal, or local law, therefore each entity may also further regulate pesticide use.

National Historic Preservation Act (NHPA) of 1966, as amended

The NHPA and its implementing regulations (36 CFR 800) require federal agencies to initiate the section 106 process if an agency determines that the agency's actions are undertakings as defined in Sec. 800.16(y) and, if so, whether it is a type of activity that has the potential to cause effects on historic properties. If the undertaking is a type of activity that does not have the potential to cause effects on historic properties, assuming such historic properties were present, the agency official has no further obligations under section 106. The Advisory Council on Historic Preservation (ACHP) and each state's State Historic Preservation Officer (SHPO) or the tribal government Tribal Historic Preservation Officer THPO) have the primary non-regulatory jurisdiction. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, the site-specific consultation as required by Section 106 of the NHPA would be conducted with the SHPO or THPO as necessary.

The Native American Graves and Repatriation Act of 1990

The Native American Graves Protection and Repatriation Act (Public Law 101-106, 25 USC 3001) requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal agencies are to discontinue work until the agency has made a reasonable effort to protect the items and notify the proper authority.

The Wilderness Act (Public Law 88-577(USC 1131-1136))

The Wilderness Act established a national preservation system to protect areas "where the earth and its community life are untrammeled by man" for the United States. Wilderness areas are devoted to the public for recreational, scenic, scientific, educational, conservation, and historical use. This includes the grazing of livestock where it was established prior to the enactment of the law (Sept. 3, 1964) and damage management is an integral part of a livestock grazing program. The Act did leave management authority for fish and wildlife with the state for those species under their jurisdiction.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect native species of birds that migrate outside the United States. The law prohibits any "take" of these species, except as permitted by the FWS. The Migratory Bird Treaty Act established a Federal prohibition, unless permitted by regulations, to pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird or any part, nest, or egg of any such bird. FWS released a final rule on November 1, 2013 identifying 1,026 birds on the List of Migratory Birds (FWS 2013). Species not protected by the Migratory Bird Treaty Act include nonnative species introduced to the United States or its territories by humans and native species that are not mentioned by the Canadian, Mexican, or Russian Conventions that were implemented to protect migratory birds (FWS 2013). Based on evidence that migratory game birds have accumulated in such numbers to threaten or damage agriculture, horticulture or aquaculture, the Director of the USFWS is authorized to issue a depredation order or special use permit, as applicable, to permit the killing of such birds (50 CFR 21.42-47). In severe cases of bird damage, WS provides recommendations to the USFWS for the issuance of depredation permits to private entities (50 CFR 21.41). Starlings, pigeons, House Sparrows and domestic waterfowl are not classified as protected migratory birds and therefore have no protection under the MBTA. Where complying with the conditions of an existing USFWS depredation order for blackbirds, cowbirds, crows, grackles, and magpies, Federal, State, and Tribal employees do not need a Federal permit to control these species where, among other conditions, they are causing serious injuries to agricultural or horticultural crops or to livestock feed or causing a health hazard or structural property damage (50 CFR 21.43). Nonlethal methods must be attempted prior to use of lethal control.

Bald and Golden Eagle Protection Act (BGEPA)

This law provides special protection for bald and golden eagles. Similar to the Migratory Bird Treaty Act, the Bald and Golden Eagle Protection Act (16 U.S.C. 668 et seq.) prohibits the take of bald or golden eagles unless permitted by the Department of the Interior. The term "take" in the Act is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Disturb is defined as any activity that can result in injury to an eagle, or cause nest abandonment or decrease in productivity by impacting breeding, feeding, or sheltering behavior.

Occupational Safety and Health Act of 1970

The Occupational Safety and Health Act of 1970 and its implementing regulations (29 CFR 1910) on sanitation standards states that, "Every enclosed workplace shall be so constructed, equipped, and maintained, so far as reasonably practical, as to prevent the entrance or harborage of rodents, insects, and other vermin. A continuing and effective extermination program shall be instituted where their presence is detected." This standard includes mammals that may cause safety and health concerns at workplaces.

Federal Food, Drug, and Cosmetic Act (21 USC 360)

This law places administration of pharmaceutical drugs, including those immobilizing drugs used for wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 USC 821 et seq.)

This law requires an individual or agency to have a special registration number from the United States Drug Enforcement Administration to possess controlled substances, including controlled substances used for wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994

The Animal Medicinal Drug Use Clarification Act (AMDUCA) and its implementing regulations (21 CFR 530) establish several requirements for the use of animal drugs, including those animal drugs used to capture and handle wildlife in damage management programs. Those requirements are: (1) a valid "veterinarian-client-patient" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under any alternative where WS could use those immobilizing and euthanasia drugs. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period after a drug was administered that must lapse before an animal may be used for food) for specific drugs. Animals that people might consume within the withdrawal period must be identifiable (e.g., use of ear tags) and labeled with appropriate warnings.

Fish and Wildlife Act of 1956 (section 742j-1) - Airborne Hunting

The Airborne Hunting Act, passed in 1971 (Public Law 92-159), and amended in 1972 (Public Law 92-502) was added to the Fish and Wildlife Act of 1956 as a new section (16 USC 742j-l). The USFWS regulates the Airborne Hunting Act but has given implementation to the States. This act prohibits shooting or attempting to shoot, harassing, capturing or killing any bird, fish, or other animal from aircraft except for certain specified reasons. Under exception [see 16 USC 742j-l, (b)(1)], state and federal agencies are allowed to protect or aid in the protection of land, water, wildlife, livestock, domesticated animals, human life, or crops using aircraft.

Presidential Executive Orders

Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (Executive Order 12898)

Executive Order 12898 promotes the equitable treatment of people of all races, income levels, and cultures with respect to the development and implementation of federal actions, and enforcement of environmental laws, regulations and policies. Executive Order 12898 requires federal agencies to make environmental justice part of their mission, and to identify and address, when appropriate, disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income persons or populations.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045)

Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. This executive order requires federal agencies to evaluate and consider during decision-making the adverse impacts that the federal actions may have on children.

Invasive Species (Executive Order 13112)

Executive Order 13112 establishes guidance for federal agencies to use their programs and authorities to prevent the spread or to control populations of invasive species that cause economic or environmental harm or harm to human health. The Order states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law: 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations and provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control and promote public education of invasive species. This EO created the National Invasive Species Council (NISC).

Consultation and Coordination with Indian Tribal Governments (EO 13175)

This EO directs federal agencies to provide federally recognized tribes the opportunity for government-to-government consultation and coordination in policy development and program activities that may have direct and substantial effects on their tribe. Its purpose is to ensure that tribal perspectives on the social, cultural, economic, and ecological aspects of agriculture, as well as tribal food and natural-resource priorities and goals, are heard and fully considered in the decision-making processes of all parts of the Federal Government.

Facilitation of Hunting Heritage and Wildlife Conservation (Executive Order 13443)

This order directs Federal agencies that have activities that have a measurable effect on outdoor recreation and wildlife management, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat. It directs federal agencies to cooperate with states to conserve hunting opportunities. APHIS-WS cooperates with state wildlife and other resource management agencies in compliance with applicable state laws governing feral swine management. State, territorial, and tribal agencies, not APHIS, have the authority to determine which species are managed as a game species, hunted, eradicated, contained, or managed for local damages.

Incorporating Ecosystem Services into Federal Decision Making (Presidential Memorandum 10/7/2015)

This memorandum directs Federal agencies to develop and institutionalize policies to promote consideration of ecosystem services, where appropriate and practicable, in planning, investments, and regulatory contexts. This effort includes using a range of qualitative and quantitative methods to identify and characterize ecosystem services, affected communities' needs for those services, metrics for changes to those services, and, where appropriate, monetary and nonmonetary values for those services. It also directs Federal agencies to integrate assessments of ecosystem services, at the appropriate scale, into relevant programs and projects, in accordance with their statutory authority.

Appendix E. Supplemental Details for Section 3.5. Impacts on Predator Species Populations

Table E.1. Annual average intentional lethal take of predators by WS-Montana during IPDM activities, FY2013- FY2017.

Method: 5 year total/annual average	Coyote	Black Bear	Striped skunk	Raccoon	Mountain Lion	Red Fox	Badger	Bobcat	Feral Cat	Grizzly Bear	Gray Wolf	Feral Dog	Common Raven	Feral Swine	5 yr. total /Ave per yr.
Fixed Wing	4,273/ 854.6	0	0	0	0	6/ 1.2	0	0	0	0	46/ 9.2	0	0	0	**4,325/ 865**
Helicopter	16,287/ 3,257.4	0	0	0	0	44/ 8.8	0	0	0	3/ 0.6	131	0	0	0	**16,465/ 3,293**
Foot-hold Trap	697/ 139.4	0	32/ 4	1/ 0.2	27/ 5.4	131/ 26.2	8/ 1.6	0	1/ 0.2	0	41/ 8.2	0	0	0	**938/ 187.6**
Cage Trap	0/ 0	0/ 0	2/ 0.4	0/ 0	17/ 3.4	2/ 0.4	0	0	0	0	0	0	0	0	**21/ 4.2**
Neck Snare	3,410/ 682	1/ 0.2	12/ 2.4	22/ 4.4	10/ 2	371/ 0.2	30/ 6	1/ 0.2	0	0	6/ 1.2	0	0	0	**3,863/ 772.6**
Foot Snare	1/ 0.2	19/ 3.8	0	0	6/ 1.2	0	0	0	0	1/ 0.2	1/ 0.2	0	0	0	**28/ 5.6**
Culvert Trap	0	11/ 2.2	0	0	0	0	0	0	0	0	0	0	0	0	**11/ 2.2**
Decoy Trap	0	0	0	0	0	0/ 0	0	0	0	0	0	0	3	0	**3/ 0.6**
Firearms	4,643/ 928.6	17/ 3.4	1/ 0.2	0	12/ 2.4	19/ 3.8	1/ 0.2	0	1/ 0.2	0	35/ 7	0	26	0	**4,755/ 951**
Night vision	0	1/ 0.2		0	0	0	0	0	0	0	0	0	0	0	**1/ 0.2**
M-44 Cyanide Capsule	2,242/ 448.4	0	0	0	0	85/ 17	0	0	0	0	0	0	0	0	**2,327/ 465.4**

DRC-1339	0	0	0	0	0	0	0	0	0	0	0	0	576/ 115.2	0	**576/ 115.2**
Nests Destroyed Hand Tools	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**1/ 0.2**
Dens Destroyed Sodium Nitrate	95/ 19	0	0	0	0	60/ 12	0	0	0	0	0	0	0	0	**155/ 31**
5 year total take by species	31,933	49	47	23	72	898	39	1	2	4	260	0	606	0	**-**
Annual Avg. take by species	**6,386.6**	**9.8**	**9.4**	**4.6**	**14.4**	**179.6**	**7.8**	**0.2**	**0.4**	**0.8**	**52**	**0**	**121.2**	**0**	**-**

Projected Annual Maximum Take

WS-Montana annual maximum take is represented as the highest projected take of a species in a given year under the current action (Alternative 1) adjusted for potential increases in the level of assistance requested. Because there are many variables that correspond with WS-Montana's take of predators that differ greatly between species, no single formula dictates annual maximum take projections. Instead, WS-Montana analyzes historical take data, historical requests for assistance from all parties, environmental conditions (e.g. reduced availability of other food sources) that could increase take and/or requests for assistance, and other species-specific factors to determine the projected annual maximum take for each species considered in this EA.

Under no circumstances should the projected WS annual maximum take be interpreted as the target number of animals WS-Montana seeks to remove, nor does APHIS-WS have a policy of ever taking the maximum sustainable harvest proportion of the population for any species, with the exception of non-native invasive species, such as feral swine (Section 3.5.15).

Appendix F. Summary of the Relevant Scientific Literature: Trophic Cascades

What is the Purpose of this Appendix?

The study of ecological trophic cascades is relatively new and very complex, with potentially many highly interrelated factors and inherent complications to developing and implementing robust studies and ecological computer models. Statistical analyses must be carefully chosen and applied to develop strong correlations and reasonable interpretation of study results. Different ecosystems may have inherently higher productivity than others, resulting in different comparative study outcomes. Each study looks at a very small question related to very broad and complicated interrelated systems, and a particular study addressing a specific question cannot be expected to provide an answer that can be applied broadly.

Therefore, this appendix simply briefly summarizes the scientific literature relevant to the broader questions related to trophic cascades and related factors subsumed within that possible ecological relationship. It is not intended to be an impact analysis related to WS-Montana IPDM actions, but rather provides the context for the impact analysis in Section 3.8. This appendix focuses on peer-reviewed published scientific literature, but because certain unpublished or non-peer-reviewed documents are frequently raised by commenters, they are included for context.

What Foundational Ecological Topics Inform the Discussion on Trophic Cascades?

How do Carnivores Contribute to Ecosystem Biodiversity?

Large terrestrial mammalian carnivores, such as wolves, coyotes, and dingoes, have been historically seen as threats to human lives, property, and domestic livestock (Schwartz et al. 2003, Ray et al. 2005, Prugh et al. 2009, Estes et al. 2011). Large mammalian carnivores have high metabolic demands due to being warm-blooded, and they have a large body size with large surface to volume ratio. Therefore, they typically require large prey and expansive, connected, unfragmented habitats. These characteristics often bring them into conflict with humans, their property, and livestock, and compete for wildlife that are also regulated game species.

Large carnivores are vulnerable to many human-created conditions, including habitat loss, degradation, and fragmentation, invasive and exotic species, climate change, and hunting, as well as to widespread lethal control conducted in response to human intolerance, often resulting in population depletion, extirpations, and extinctions (Ripple et al. 2014). Hunting by humans does not duplicate or replace natural predation because it differs in intensity and timing, resulting in dissimilar effects on prey behavior, age, and sex (Ripple et al. 2014, Ray et al. 2005). However, where large carnivores were once seen as impediments to conservation goals, including for protection of endangered species, they are now increasingly considered as essential players in efforts to preserve ecosystem biodiversity through structuring ecosystem interactions and providing ecological services (Ray et al. 2005, Wallach et al. 2008).

How are Ecosystems Structured?

Ecosystems are structured through the dynamic interactions of abiotic factors such as weather, soil productivity, climate change, and surface and subsurface hydrology, natural perturbations such as wildfire, and the variety, composition, and abundance of fauna and vegetation present. Those dynamics change in abundance, variety, and distribution as components of the ecosystems change.

Studies suggest that large carnivores may directly and/or indirectly affect the populations of certain species in terms of presence, abundance, reproductive success, activities, and function within the ecosystem. These effects may partially result from their predatory activities on smaller animals, including other carnivorous predators (such as foxes, coyotes, and cats), animals that eat only vegetation (herbivores, such as rabbits and deer), and animals that eat both vegetation and meat (omnivores, such as bears, badgers, and raccoons). These effects can also change the biomass, variety, and productivity of the vegetation that is eaten by herbivores and omnivores. These relationships based on consumption is called a **food web**, which recognizes the web-like interaction of a set of interrelated food chains, including species that share the same foods and carnivores that consume other carnivorous species.

Within these webs, animals with similar food habits create **trophic levels**, where energy is transferred and transformed as animals from one level feed on animals or plants from a lower level. If interactions occur from one trophic level of the web to a higher or lower trophic level, this is considered a **vertical relationship**. If the interaction occurs within the same trophic level, such as when a larger predator kills or feeds on a smaller predator or omnivore, it is considered a **horizontal relationship**. Therefore, the large carnivores are considered apex predators (in the vertical relationship), because they are not naturally preyed on by other animals, except by humans (Duffy et al. 2007).

Therefore, an **apex** or **top predator** is defined as a species that feeds at or near the top of the food web of their supporting ecosystem and that are relatively free from predation themselves once they reach adult size (Sergio et al. 2014). As animals in each trophic level need to use some of the energy obtained through consumption for maintenance, growth, activities, and reproduction, a much smaller amount of energy is transferred from a lower trophic level to a higher one. This generally results in a fewer number of animals within each higher trophic level. The top trophic level of a food web generally has fewer species and smaller population sizes than lower levels (and typically larger body sizes), resulting in the need to feed on larger prey with less energy expended in order to meet their energy requirements for survival. Top carnivores also tend to be more vulnerable to sustained adverse perturbations in their environment and persistent high mortality rates, and therefore more susceptible to extirpation and extinction.

What is the History of the Study of Ecosystem Functions and Roles of Apex Predators?

The history of recognizing the ecological roles of apex predators as something other than vermin or pests is relatively new (Ray et al. 2005). The concept was popularly introduced by Charles Darwin's *Origin of Species* (1859) in his concept of mutualism (domestic cats controlling mice, that that would otherwise eat bee honeycombs, affecting plants and pollinators; Ripple et al. 2016) In more contemporary times, the concept of top predators was publicized primarily by Aldo Leopold in 1943. In the 1950s and 1960s, relatively simple studies were conducted on the dynamic interrelationships of predators and their prey, using uncomplicated models and limited field experiments. In the 1970s, simple modeling and empirical field studies began to test the capabilities of top predators to ecologically structure lower trophic levels, evaluate the relationships between predator and prey, confer stability to populations, and cause ecosystem shifts between alternative stable states (e.g., Ballard et al. 1977, Stenseth et al. 1977).

In the 1980s, modeling and field studies expanded in complexity to include predator-prey relationships, population dynamics, and adaptive social behavior in response to the risk of being predated, including how behavior changes affected foraging behavior and life history of prey and how these dynamics interrelate ecologically. Studies also began considering the potential for some predators to eat other predators, acknowledging a food web that interacts both vertically and horizontally, and the potential to cause trophic cascades. In the 1990s, these studies became increasingly complex, further investigating the roles of predation risk and anti-predator behavior adaptations, and how these affect the fitness of an individual animals, populations, and communities, potentially contributing to behavior-mediated trophic cascades (Sergio et al. 2014).

Presently, studies are branching into increased use of field and interdisciplinary research to investigate more realistic community, food web, population, ecological community, and individual animal responses to manipulations, and intended perturbations of communities of predators and prey, including direct and indirect behavior adaptations, ecological roles, predators killing other predators, and individual and species specializations of apex predators. Empirical field studies are increasingly using more sophisticated technologies to study wide ranging and secretive top predators, such as GPS satellite tags and collars (Sergio et al. 2014).

Originally, field studies were conducted on mostly sessile or low mobility species and webs, such as invertebrates, spiders, plankton, and small fish in localized ecosystems in relatively high productivity streams, lakes, intertidal zones, grasslands, and agricultural areas (e.g., Schmitz et al. 2004, Ray et al. 2005, Beschta and Ripple 2006). Expanding these studies to open ocean marine and terrestrial ecosystems with more wide-ranging predators and prey that are inherently more difficult to manipulate and create perturbations in, especially without causing moral, ethical, and political controversy, created extensive challenges in methodologies and complexity (e.g., Ray et al. 2005, Brashares et al. 2010, Estes et al. 2011, Sergio et al. 2014). Researchers also questioned whether the correlative results of studies that are small scale in time and/or space and conducted in ecologically relatively simple and localized ecosystems such as grasslands, agricultural fields, salt marshes, and marine intertidal zones could be extrapolated and applied to larger scale circumstances associated with trophic interactions in marine and terrestrial ecosystems across broad land and seascapes (e.g., Loreau et al. 2001, Srivasta and Vellend 2005).

It is extremely difficult to establish complex causal links between the indirect effects of top predators cascading over several trophic levels, and is still the subject of modern studies. Only recently have researchers conducted empirical studies of the roles of large carnivores in structuring communities, including the roles in ecosystem stability, biodiversity, and ecosystem functions (Ray et al. 2005).

What is a Trophic Cascade?

In theory, apex predators may shape major shifts in the structure and function of ecosystems, as their predation and behavior ripple down and across food webs. These apparent ripple effects can create alternative and possibly long-term ecologically stable states that differ from the original state before the perturbation to apex predators, which ultimately becomes the persistent state (**homeostasis**). These changes may progress smoothly over time as the changes themselves occur, or, more likely, may occur when some threshold or "tipping point" is reached, at which point the structure and/or function shifts to different stable condition. During this phase shift, the conditions may rapidly fluctuate and species populations may rapidly increase then crash, before settling into the subsequent new and persistent condition.

Theoretically, the loss of one or more apex predators may result in shorter links within the food web because the apex predator is no longer present. This can potentially result in the release (in terms of numbers, distribution, biomass, etc.) of smaller predator and/or omnivore species that the apex predator preyed upon or behaviorally controlled. **Behavioral control** means that the prey exhibited adaptive anti-predator behavior that lowered its ability to forage optimally or kept individual animals in chronic physiological stress, resulting in lower overall fitness at the individual and community levels. In other words, the species' population was controlled by apex predators in such a way that the prey population could not reach the **carrying capacity**, or the maximum number of a species that the environment can support indefinitely (i.e., due to natural abundance of food and habitat resources). When the apex predator is at too low an abundance or density to create ecological restrictions on the prey population, or is no longer present, the controlled predator species may be released from the top-down control formerly exerted by the apex predator, and typically becomes the apex predator of the now-shifted system.

Theoretically, populations controlled by the new top predator may now release control on their prey, which may be herbivores, small mammals, or even vegetation. For a simple example, coyotes may now exert a greater predatory pressure on red foxes, decreasing their numbers, which may then release control on small rodents, resulting in increasing rodent populations. If this release is sufficiently high, the small rodent population may then increase dramatically, which may subsequently suppress the species composition or biomass of the vegetation eaten by the mice. This vertical control from top predators that may ripple through the food web is called **top-down control**.

The web is further complicated by a horizontal interaction within a food web, when one predator preys upon or otherwise controls another predator. This sideways feeding is called **intraguild predation** or **IGP**. A **guild** is made up of species that tend to play similar roles within a food web, such as carnivore, omnivore, or herbivore. See Section F.8.1 for more information on IGP.

When the population of the smaller predator (intraguild prey) is released by the extirpation, extinction, or severe control of the intraguild predator, that dynamic is called

mesopredator release. A mesopredator species tends to be an intermediate predator within a food web, one that is typically smaller than the lost apex predator species, more of a generalist in terms of diet, and may be small enough to exploit more potential food niches. Mesopredator species often have a relatively high intrinsic rate of increase because of high reproductive rates and/or because they respond with higher reproductive rates when their populations are below carrying capacity (called a **density dependent response**) and the populations are released from suppression. Examples of mesopredators that may be released when wolves (as top carnivore) are severely suppressed or extirpated from an area could be coyotes, badgers, foxes, raccoons, and feral and free-ranging cats, depending on the composition of the ecological community. Generally, under these circumstances, the coyote population then fills the trophic role of apex predator, alternatively exerting control and releasing species, depending on whether the impact is direct or indirect on the particular trophic level. See Section F.8.2 for more information on mesopredator release.

It is also possible that predator species may be indirectly controlled by lack of prey or low vegetative productivity. For example, a multi-year drought may reduce the plant forage of rabbits, reducing both the rabbit population and its intrinsic reproductive rate. This, in turn (with a lag time), may suppress the physiological fitness and intrinsic reproductive rate of its primary predator, for example, a coyote. This is called **bottom-up control**. Coyotes may then begin to feed more on foxes (an IGP situation occurring within the relatively same trophic level), which were not affected by the drought, because the plants that the small rodents fed on (different from the plants that the rabbits fed on) were more resistant to the effects of drought. If the IGP by coyotes on foxes is sufficiently high, the fox population may again be suppressed, releasing the mouse populations. Complicating this concept is that both top-down and bottom-up controls may occur simultaneously for the same and different components within the same ecosystem (Borer et al. 2005, Ritchie and Johnson 2009). Such top-down and bottom-up effects can be complicated by **interference competition** (where dominant predators interfere in the ability of subordinate predators to obtain resources), site productivity, behavioral adaptation to avoiding the risk of predation and obtaining high quality resources, and intrinsic "noise" in the ecosystem due to natural variation (Elmhagen et al. 2010). In the above example, coyotes could switch from rabbits to other smaller rodents and insects (prey switching) that foxes prey on and compete with the foxes for the same prey base.

These apparent up and down (or lateral) alternating trophic interrelationships (when one population increases, it may cause a decrease in another (a direct effect) and increase in a species in the next lower trophic level (an indirect effect), which may indicate an interrelationship among trophic levels called a **statistical correlation** (Section F.6.1). However, such correlations do not indicate that one relationship is actually caused by the other. For example, large irruptions of mouse populations may be interpreted as being indirectly related to, for example, removal of a predator that feeds on mice, but may actually be caused by factors that were not considered, such as human food subsidies.

Polis et al. (2000) also recommend that researchers distinguish between potential cascading or rippling interactions at the species level (those occurring within a subset of the food web of a community, such that changes in predator numbers affect the success of one or more subsets of the plant species) and at the community level (those occurring where cascades considerably alter the distribution of plant biomass through the trophic levels of the entire system). This adds further complexity to empirical studies and interpreting results.

It is inherently extremely difficult, if not impossible in many circumstances, to develop and implement study protocols for field experiments resulting in statistically strong correlations. It is also inherently difficult to determine, even with replication of studies resulting in similar correlations, that inter- and intra-trophic relationships are caused by ecological perturbations, such as the removal of an apex predator, or that the removal results in a trophic cascade. Frequently, top-down effects do not appear as strong or to produce predicted cascading effects in terrestrial ecosystems due to the complexity of factors, such as the effects of dispersal and immigration, social regulation, and interference competition among predators, and abiotic factors, such as weather, soil, ecosystem productivity, and spatial and temporal habitat heterogeneity (Halah and Wise 2001, Ray et al. 2005, Berger et al. 2008, Estes et al. 2011).

Section F.13 details the inherent challenges of modeling and designing empirical field studies that determine statistically-correlated interrelationships between ecological factors. These studies may indicate needs for further investigation or potentially establish factors that can be shown to create a direct causation for the observed effect through study replications. Terrestrial ecosystems, food webs, and their processes are especially complex, with wide-ranging apex predators and intricate and adaptive predator and prey behaviors.

What is the History of the Concept of Trophic Cascades and its Definitions?

Since the 1980s when Paine (1980) used the term "trophic cascade" to describe food webs in intertidal marine communities, trophic cascade has been a central or major theme of more than 2,000 scientific articles across many different ecosystems worldwide. Polis et al. (2000) and Ripple et al. (2016) expressed concern that, after decades of studies and modeling in many different ecosystems, the definitions and language used to describe trophic cascades have become inconsistent, obscuring and impeding both communication among researchers and the usefulness of the concepts for application in ecological management and conservation. To be useful and contribute to clarity, the definition must be both widely applicable yet sufficiently explicit to exclude extraneous interactions.

Ripple et al. (2016) provide a summary of the various definitions provided by researchers between 1994 and 2006. Trophic cascades were thought to only occur from upper trophic levels to lower trophic levels (top-down), until Terbough (2006) suggested that cascades can ripple either up or down a food web, with alternating negative and positive effects at successive levels. The first indirect effects of predators on plankton in lakes were suggested in the 1960s (Brooks and Dodson 1965, Hrbacek et al. 1966). Subsequently, Estes and Palmisano (1974) described the role of sea otters in structuring nearshore communities of sea urchins and kelp, later modified to include orcas and sea lions, based on changes caused by humans (Estes et al. 1998), a frequently cited example in the literature to this day. The research on trophic cascades began to shift from being dominated by studies in freshwater systems and old field grasslands and croplands to being dominated by terrestrial and marine systems in the early 2000s.

Based on a recent meta-analysis of scientific literature, Ripple et al. (2016) suggest trophic cascades be defined as indirect species interactions that originate with predators and spread downward through food webs. According to the authors, this definition does not require that trophic cascades begin with apex predators, nor that trophic cascades end with plants. The authors suggest that bottom-up effects are not downward trophic cascades, but what they call **knock-on effects**, in which effects spin-off from the main top-down interactions. Whether or not bottom-up effects are incorporated into the definition of trophic cascades (as Terbough et al. 2001, Ripple et al. 2013, and Ripple et al. 2015 suggest), research has indicated that effects may flow both directions at different times in dynamic ecological systems in which top and mesopredators are present and active. Such top-down and bottom-up effects can be complicated by **interference competition** (as mentioned in the coyote example above).

What is the Difference between Correlation and Causation in Interpreting Statistical Study Results?

Before evaluating the scientific literature, it is important to explicitly define the difference between correlation and causation in order to better understand the statistical results of these studies. These terms are often misunderstood and misused when interpreting scientific papers. This discussion on correlation and causation is adapted from the Australian Bureau of Statistics (ABS 2013).

Correlation

A **correlation** is a statistical measure (expressed as a number) that describes the size and direction of a relationship between two or more variables. A correlation is suggested by a positive or negative relationship – when one factor increases, another may also increase (**positive correlation**) or decrease (**negative**, or **inverse**, **correlation**). If an apparent correlation is observed statistically, it does not mean that one factor causes the other, only that the one factor either goes up or down in relation to the other factor.

The strength of the apparent correlation, or the indication that there truly is some level of interrelationship, is determined using statistical formulas that should meet assumptions pertinent to the context of the data and the system being studied. The formulae provide a figure, known as the square of the correlation coefficient, or R^2, which is always a number between 0 and 1. A value closer to 1 suggests that a stronger correlation exists, indicating that the relationship may warrant further investigation and study. However, it is possible to identify strong, but meaningless, correlations, and many other factors may introduce complexity into the relationships as well as confound the apparent results.

As an example of an apparent, but not necessarily actual, correlation, we can use the observance of the onset of cold weather in the winter and increasing numbers of colds. As the temperature decreases in December, it may appear that people get more colds, an apparent inverse correlation. That could be a correlation, and an R^2 value may actually indicate a strong correlation. However, the cold temperatures also tend to occur during the holiday season. The suggested correlation between decreasing temperatures and increasing rates of illness may actually be more closely related to depressed immune systems from eating more sugar and increased exposure to viruses from greater contact with people. Despite an apparent correlation, it is also possible that decreasing December temperatures themselves do not directly cause increased rates of illness, and therefore wearing warmer clothes will not necessarily decrease the number of colds or the risk that an individual person will catch one.

The suggested statistical correlation can be confounded by many variables that may or may not have been incorporated into the statistical analysis, potentially resulting in misleading results. In another well-known example, the R^2 for the number of highway fatalities in the US between 1996 and 2000 and the quantity of lemons imported from Mexico during the same period is R^2=0.97 – a very strong correlation – but it is extremely unlikely that one causes the other. Generally, scientists and researchers will reject factors that show a weak correlation, but completely irrelevant factors can produce a statistically high R^2 coefficient, potentially leading researchers in the wrong direction.

Causation

Causation indicates that one event is the result of the occurrence of the other event. Proving that a strong statistical correlation is directly responsible for an observed result requires more than a high R^2 value. Once a strong correlation is indicated, researchers experimentally need to test their hypotheses for causation to determine if indeed the factor(s) considered in the statistical analysis caused the result (cause-and-effect relationship), rather than just suggesting a relationship. They need to determine that the result is not just varying up or down statistically in unrelated or potentially indirect ways, or that the results may be confounded by untested or unmeasured factors. For strengthening a potentially causal relationship, the tests must be replicated by other researchers using the same methods, scale, and contexts to determine if the results are truly causative.

A powerful research protocol is one that holds all factors constant but one, and then tests for statistically significant changes that indicate a causative relationship. The variable factor can also be changed and the results tested to further clarify a causative relationship. A statistically significant finding is one that would occur more often than it would if it were to occur randomly.

Conclusion

When relying on studies, it is critical to understand that statistical correlations, which are offered by researchers as suggestive or indicative results often without replication, are different from conclusions of statistically significant causation. Ray et al. (2005) state that researchers are often influenced by numerous factors, including their education, cultural background, and inherent conditions of the ecological systems on which they work. Ecologists who specialize in some systems often favor certain hypotheses, interpretations, and factors measured, and discount others developed, to inform work on other systems.

Misinterpreting weak, or even strong, correlations or the results of theoretical models as indicative of causation is inappropriate and does not credibly represent the state of the science or the robustness of data and research protocols. More importantly, it can lead to uninformed decision-making and poor choices regarding conservation and management actions that may have unintended and damaging consequences. APHIS-WS reviews the pertinent literature and places priorities on studies that accurately account for correlations, have relevant assumptions, and disclose study and statistical limitations and strengths.

What do Relevant Studies Suggest about Trophic Cascades?

The following studies are representative of empirical field research conducted on large predators in terrestrial ecosystems that are useful for understanding the complexities of trophic cascades and contributing processes:

- **Hebblewhite et al. (2005)**, in a study in Banff National Park (NP), suggested that human activity, including recreation, in one valley restricted the use of the area by wolves, while limited human activity in an adjacent valley allowed higher wolf use. Survival recruitment of female elk and recruitment of calves was higher in the valley with human activity and lower wolf numbers. Elk competed with beaver for willow in riparian areas could have important impacts on biodiversity and ecosystem function and structure. The authors suspected wolves were the primary correlating factor in the observed cascading effect, but recognized that other predators may be implicated to an unknown degree.
- **Ripple and Beschta (2006)** hypothesize that an increase in human recreation in Zion NP resulted in a catastrophic regime shift to lower mountain lion densities and higher mule deer densities, higher herbivory on cottonwood trees, lower recruitment of young trees, increased bank erosion, and reductions in both terrestrial and aquatic species abundance. A top-down trophic cascade model would predict an increase in producer biomass following predator removal, while a bottom-up model would predict little or no change in consumer or producer biomass. Additionally, other likely interaction pathways include increased species interactions, improved nutrient cycling, limited mesopredator populations, and food web support for scavengers. The canyon with low human activity showed high recruitment of cottonwoods, hydrophytic plants, wildlife, amphibians, lizards, and butterflies along the creek, as well as presence of small endemic fish, with fewer eroded banks and altered channel widths. The diminishment of cottonwood forests in the riparian area reflects a potentially strong trophic cascade with ultimate effects on the structure and ecology of stream floodways, with decreased biodiversity. Without an appreciation of the potential for abrupt regime shifts and resulting new and persistent ecological stasis, the authors hypothesize that studies involving the removal of top predators are likely to provide conflicting results regarding function and structure of perturbed systems.
- **Ripple and Beschta (2007)** reported evidence of reduced browsing and increased heights of young aspen, particularly at areas with high predation risk (riparian areas with downed logs) after wolves were reintroduced into Yellowstone NP. Young aspen in upland settings showed continued suppression, consistent with the combined effects of trophic cascades, mediated by adaptive behavior related to predator risk avoidance by elk and lower densities of elk, indicating a recovering ecosystem. Much of the aspen growth observed in riparian areas after the reintroduction of wolves appears due to reduced browsing by elk at sites with poor escape terrain and reduced visibility, rather than climate change or site

productivity. The patchy recovery of as evidenced by increases in aspen height in the uplands as compared to riparian areas is consistent with recently reported patchy release of willow in Yellowstone (Ripple and Beschta 2006). The authors suggest that elk may be avoiding browsing certain riparian areas as an anti-predator strategy. The authors recognized that the broad-scale application of the results of this study are limited by the lack of an experimental control (area with no wolves) since the entire area was recolonized by wolves and that the data most likely represent the beginning of aspen recovery and not aspen population responses across Yellowstone's northern range. Concurrent increases in bison populations in Yellowstone's northern range may also be affecting the status of aspen communities.

- **Berger et al. (2008)**, in an often-cited article, suggested that wolf predation on coyotes in the Greater Yellowstone Ecosystem released the heavy coyote predation on pronghorn antelope fawns, resulting in increased pronghorn survival. The pronghorn population studied had not recovered from heavy market hunting, and the study found that fawn survival was four times higher in areas used by wolves where wolves predated on coyotes than in areas not used by wolves. Observed differences in fawn survival in areas with wolves may be sufficient to reverse the currently declining pronghorn population.
- **Kauffman et al. (2010)** suggest that, contrary to Ripple and Beschta (2006, 2007), survivorship of young browsable aspen are not currently recovering in Yellowstone NP, even in the presence of a large wolf population. A marked reduction in elk followed wolf reintroduction at the same time that drought reduced forage availability and hunting by humans increased outside the park during and after winter elk migration, indicating that the difference in aspen recover may be based on factors other than response to predation. Contrary to findings of previous researchers, the authors suggest that much of the variation in aspen reproduction was not due to elk browsing levels in response to predation risk, but to site productivity. Patterns of aspen recruitment are consistent with the effects of a slow and steady increase in elk abundance following the end of market hunting in the late 1800s and wolf extirpation in the 1920s. The authors' interpretation suggests that landscape level differences in habitat more strongly determined where wolves killed elk. Also contrary to Ripple and Beschta (2007), these authors suggest that aspen growth differences were due to the confounding patterns associated with abiotic factors such soil moisture, mineral content or patterns of snow accumulations, which vary widely across the landscape. Aspen sucker survivorship was lower near wolf territory core areas, likely due to wolves maintaining territories in areas of high elk densities, limiting the cascading impacts of behavioral changes due to predation risk, which apparently occur only in response to the near imminent threat of wolf predation. The authors suggest that aspen recovery across the northern range of Yellowstone NP will occur only if wolves in combination with climate and other predators further reduce elk populations.
- **Brown and Conover (2011)** conducted a large-scale removal of coyotes on twelve large areas in Utah and Wyoming to study effects on pronghorn antelope

and mule deer populations. Their data suggest that coyote removal conducted during the winter and spring provided greater benefit than removals conducted during the prior fall or summer for increasing pronghorn survival and abundance. Unlike that for pronghorn, the data suggest that coyote removal during any season does not affect mule deer populations.

- **Ripple and Beschta (2011)** repeat earlier aspen and cottonwood surveys and measure browsing heights to determine recovery of aspen in the northern range of Yellowstone NP. The authors suggest that browsing on the tallest aspen stems decreased from 100% in 1998 to averages of less than 25% in the uplands and less than 20% in the riparian areas by 2010, increasing aspen recruitment and growth. Synthesis of trophic cascade studies conducted in Yellowstone NP within 15 years after wolf reintroduction generally indicate that the reintroduction of wolves restored trophic cascade with woody browse species growing taller and canopy cover increasing in some areas. After wolf reintroduction, elk populations decreased, and beaver and bison populations increased. Despite indications that wolf reintroduction created substantial initial effects on both plants and animals, northern Yellowstone NP appears to be in the early stages of ecosystem recovery and results may differ over time.
- **Ripple et al. (2011)** suggest that it is possible that disrupted trophic and competitive interactions among wolves, coyotes, lynx and snowshoe hares after wolf extirpation may be sufficient to chronically depress hare and lynx populations; human-caused habitat fragmentation and livestock presence may have added to the depressed populations in Banff NP. With wolf extirpation, coyotes predated on hares, competing with lynx. The authors hypothesize that warming climates may increase coyote predation on hares in areas with lower snowpack even at higher elevations typically used by lynx, because coyotes can better traverse areas with less deep snow.
- **Beschta and Ripple (2012)** report that, following extirpation of large predators (wolves, mountain lions, and grizzly bears) in Yellowstone, Olympic, and Zion National Parks in the early 1900s, large ungulate populations irrupted, with increased herbivory on riparian cottonwood, willow, and aspen communities. Beavers abandoned willow communities, resulting in loss of pond habitat and deepening of streams with bank erosion within twenty years. Nearly two-thirds of Neotropical migrant birds depend on riparian vegetation during the breeding season, even though riparian systems make up 1% to 2% of total land areas in the western US. As streambanks eroded, the level of coarse streambed sediments decrease with an influx of finer sediments during the erosion of floodplains which effectively fill in gravel interstices, changing benthic habitats in streams, increasing water temperature degrading fish habitats with losses of stable overhanging banks and ripple flows with low sediment loads. If apex predators are reintroduced, the effects may or may not be reversible, depending on whether the level of reduced herbivory can be sufficiently maintained.
- **Levi and Wilmers (2012)** analyzed 30 years of data involving intraguild predation involving wolves, coyotes, and foxes to determine any effect on trophic

cascades found correlational interrelationships, based on a plausible mechanism of increased interference competition between closely-sized canids. Theory suggests that guild interactions with an even number of species will result in the smallest competitor being suppressed, while guild interactions with an odd number of species may result in the smaller predator being released (Levi and Wilmers 2012).

- **Squires et al. (2012)** question the interpretations of the data published by Ripple et al. (2011), finding the correlations between recovering wolf populations and benefits to lynx populations through reduced coyote populations and through reduced competition among ungulates and snowshoe hare have weak or contradictory empirical support in the available literature. The authors believe that these findings cast doubt on the usefulness of Ripple et al.'s (2011) hypotheses and demonstrate the importance of experimental and comparative documentation when proposing trophic cascades in complex food webs. The authors caution against "publishing unsupported opinions as hypotheses that concern complex trophic interactions is a potential disservice to lynx conservation through misallocated research, conservation funding, and misplaced public perception."
- **Callan et al. (2013)** suggest that deer in Wisconsin were more abundant at the peripheries of wolf territories, based on evidence of higher deer herbivory (deer feeding on plants) on the territory margins than in core wolf territories. Understory vegetation in white cedar stands may be more influenced by bottom-up hydrology and ecological edge effects than by trophic effects. Areas with high plant diversity may increase deer densities that then attract and maintain higher wolf densities. Addressing wolf impacts at the scale of wolf territory rather than at a regional scale (rather than studying results within particular wolf territory, studies are conducted on whether wolves are present in a larger area) could have implications for study results. Research is essential to determine the level of scale at which a pattern becomes detectable above the ambient noise of ecological variation for understanding relationships between patterns and process.
- **Marshall et al. (2013)** refute conclusions of previous researchers regarding willow recovery after wolf reintroduction. In Yellowstone NP, the authors found that moderating browsing by elk alone is not sufficient to restore willows in riparian areas along small streams – such recovery depends on eliminating browsing and restoring hydrological conditions that occurred before wolves were extirpated. Beavers were common in the park, and interacted symbiotically with ecologically healthy riparian systems by the ecosystem. The riparian system provided tall willows that the beavers used to provide food and build dams, which created the hydrological conditions for healthy and sustained willow communities. Loss of beavers in the 20th century amplified the direct effects of herbivory by elk, lowered water tables, and compressed bare moist soils needed for willow establishment. In the absence of beaver creating necessary hydrologic conditions, ten years of total protection from elk browsing was not sufficient to allow willows to grow greater than two meters tall (resilient to browsing). This

study indicated clearly that bottom-up control of willow productivity due to beavers exceeded top-down control by herbivory.

- **Painter et al. (2015)** further and refute the conclusions of both Kauffman (2010) and Ripple and Beschta (2007). The authors suggest that increased wolf predation on elk after wolf reintroduction played a role in substantial decreases in elk populations, interacting with other influences such as increased predation by grizzly bears, competition for forage with expanding bison populations, and shifting patterns of human land use outside the park towards irrigated agriculture (which become more important during droughts), reduced livestock densities, and increased hunting on the elk winter ranges. Currently, a large proportion of elk now winter on irrigated fields outside the park, a strong shift in distribution. Even with the near elimination of winter elk hunting after 2005, lower wolf numbers after 2007, mild winters after 1999, a major wildfire in 1988, and the end of the regional drought in 2007, the trend of declining elk density inside the park continued through 2012. Increasing bison populations inside the park (growth of three times between 1998 and 2012), either expanded into vacated elk winter range or perhaps displaced elk. The authors argue that research conducted by Kauffman et al. (2010) and Ripple and Beschta (2007) used protocols that differed in both timing and design, potentially missing patchy aspen recovery or recovery that was in the initial stages. Where herbivory has been reduced, bottom-up factors such as site productivity may become more important drivers of young aspen and willow height. The authors conclude that changing elk dynamics and beginning aspen recovery are consistent with top-down control of large herbivores by large carnivores.
- **Ripple et al. (2015)** suggest that increases in wolf numbers after reintroduction into Yellowstone NP resulted in decreased elk populations and increases in berry-producing shrubs, including serviceberry. Increases in serviceberry may partially be due to the 1988 wildfires or other factors. With increases in berries, grizzly bears increased fruit consumption, possibly in associated with decreased whitebark pine nuts rather than the effects of trophic cascades. Evidence of a trophic cascade associated with increases in wolf populations, decreases in elk populations, and associated increases in berries, may have resulted in grizzly bears increasing consumption of berries. This may show both a top-down cascade from wolf-elk-berries, and a bottom-up response with increased berry production and grizzly bears switching to now-available berries during periods of low production of whitebark pine nuts.
- **Benson et al. (2017)** suggest that eastern coyotes have ascended to the role of apex predators since the extirpation of wolves in northeastern North America. Eastern coyote packs consumed less ungulate prey and more human-provided food than wolf packs, being more generalists. Eastern coyotes are effective deer predators and are larger than western coyote (eastern wolves are smaller than western wolves), but their dietary flexibility as generalists and low kill rates on moose suggest that they have not replaced the ecological role of wolves as apex carnivores in eastern North America.

What is the Relationship of Intraguild Predation (IGP) and Mesopredator Release (MPR) to the Potential Occurrence of Trophic Cascades?

Intraguild Predation

Interference competition, also known as competitive exclusion (Polis et al. 1989, Arjo et al. 2002, Finke and Denno 2005), is a system in which species in a community use similar diets and/or space and one species interferes with the ability of the other to optimize the use of food and habitat. Individuals of one or both species attempt to avoid this competition by using different parts of the same habitat, using the habitat at different times, and/or shifting to different foods (**resource partitioning**).

The **competitive exclusion theory** implies that coexistence of closely-related competitive species depends on resource partitioning and the degree to which shared resources are limited (Arjo et al. 2002). This is especially important when one or more predators interfere with other predator(s), called **IGP**. Relative body size and degree of trophic specialization are the two most important factors influencing the frequency and direction of IGP (Polis et al. 1989). Inherent live history characteristics such as litter size, growth rates, social structure, and density dependent interactions may influence the strength and direction of IGP correlations. IGP interactions may be directed preferentially towards predators with the closest rate of competition, often with the larger predator being dominant over the smaller (Polis et al. 1989). A review of the IGP literature found that the effects of IGP vary across different ecosystems, with the strongest patterns of IGP in terrestrial invertebrate systems. However, it is difficult to compare across systems and literature because of differences among study scales, sample sizes, and sampling methods (Vance-Chalcraft et al. 2007).

Polis et al. (1989) identified the complexities of potential types of interactions and responses associated with IGP at the population level: intraguild predators may benefit from reduced competition, especially when local resources are limited; IGP may be sufficiently intense to control populations of intraguild prey populations; intraguild predators may paradoxically increase populations of intraguild prey if the prey has density dependent responses to decreased abundance and competition; and/or presence of the IG predator may increase competition for habitat refugia.

At the community level, interactions over ecological and evolutionary time strongly influence the abundance of species. These interactions may influence distribution, resource use, and body structure, as intraguild prey often use habitat differently than their intraguild predator in space and time to avoid the risk of predation. In these early papers, Polis et al. (1989) and Arim and Marquet (2004) suggest that IGP is ubiquitous through various ecosystems, is not due to chance (found by Arim and Marquet (2004) to be statistically significant), and is a powerful interaction central to the structure and functioning of many natural communities.

Many researchers agree that the effect of IGP on trophic systems is understudied (e.g., Palomares 1995, Litvaitis and Villafuerte 1996, Palomares et al. 1996, Finke and Denno 2005). IGP is more likely to occur in predator guilds with many predator species, which increases the chances of IGP interactions (the intra-guild predator competing for shared prey and predating on other predators) and the potential for dampening trophic cascades

(Finke and Denno 2005, Daughterty et al. 2007). Based on a review of the literature on IGP theory and modeling, Holt and Huxel (2007) concluded that most models are oversimplifications of natural systems, including by not considering richer webs of interacting species across heterogeneous landscapes.

Wolves may control coyote populations through IGP and competition (Berger and Gese 2007 found a statistically significant correlation) in the Greater Yellowstone Ecosystem and Grand Teton NP. Survival rates of resident coyotes were higher than that of transient coyotes. Humans were responsible for 88% of all resident coyote deaths; predation caused 67% of all transient coyote deaths, with wolves causing 83% and mountain lions 17% of that predation. Despite IGP on coyotes by wolves, it is possible that coyotes may arrange their territories to overlap wolf activity areas, possibly in response to increased scavenging opportunities within wolf territories.

Mesopredator Release

Early studies related to the conservation effectiveness of removing large predators indicated that such removals may result in unintended increases of populations of smaller predators. The increase of smaller predator populations may have further impacts on the prey populations of those smaller predators. This concept is now referred to as **mesopredator release**.

Cote and Sutherland (1977), in an analysis of the literature, concluded that predator control is often the one factor, other than human exploitation, that can be directly managed (the others being climate, productivity, diseases and parasites, availability of territories, and accidents). Predator control may increase target populations of breeding birds, but not reliably, based on immigration and the availability of the area's carrying capacity to support more birds.

On closed systems associated with oceanic islands (systems with highly restricted opportunities for emigration and immigration) on which exotic predators such as feral cats or rats are introduced, removing the apex predator may result in irruptions of mesopredators (removing the cats eliminated the suppressive effects on rats), which may lead to extinction of the shared prey. Rats, being omnivores, may maintain high abundance and high levels of predation, even when bird populations are low (Courchamp et al. 1999, Bergstrom et al. 2009, Roemer et al. 2009). Release of mesopredators by removal of apex predators on insular islands may have many unintended consequences, including reducing nutrient subsidies from predation by small mammalian predators on large colonies of birds, altering vegetation communities; driving native species to extinction or extremely low abundance; filling niches that can no longer be filled by apex predators; and creating reservoirs of diseases carried by mesopredators (Roemer et al. 2009). Despite these problems, Russell et al. (2009) argue that removing apex predators from oceanic islands may outweigh the negative effects of MPR.

Large mammalian carnivores are particularly vulnerable to extirpation and extinction in fragmented habitat due to human development, which may result in MPR of smaller predators, which are more resilient to extirpation (Crooks and Soulé 1999, Roemer 2009). In an area highly fragmented due to residential development, the authors found positive statistical correlation between coyote abundance and mesopredator abundance, especially opossums and foxes, and negative correlation between bird diversity and grey foxes, domestic cats, opossums, and raccoons. Mesopredators avoided areas of high coyote presence both temporally and spatially. Because domestic cats are recreational hunters subsidized by their owners, approximately 35 cats (from a neighborhood of 100 homes) were present in bird habitat fragments containing a very small number of birds (Crooks and Soulé 1999).

Prugh et al. (2009) asserted that collapses in top predators caused by human influences are often associated with dramatic increases in the abundance of smaller mesopredators across many types of communities and ecosystems. The authors defined a **mesopredator** as a mid-ranking predator in a food web regardless of size or taxonomy. A mesopredator in one food web may be an apex predator in another, and may not directly fulfill the original apex predator's ecological role in the web. The occurrence of a MPR is often symptomatic of fundamental ecological imbalances due to human activities, such as habitat fragmentation, introduction of exotic species, and provision of human subsidies. Overabundant populations of mesopredators are difficult to control because the species are usually characterized by the potential for high densities, high reproductive rates and rates of recruitment, and high rates of dispersal. The authors also assert that it is difficult to root out alternative explanations for mesopredator overabundance, such as habitat changes, that often occur with or cause the loss of apex predators. Uncertainty regarding the causal mechanisms underlying mesopredator outbreaks muddies prescriptions for management.

In a commonly cited meta-analysis by Ritchie and Johnson (2009), the authors reported that more than 95% of the papers reviewed suggested evidence of MPR and/or suppression of mesopredator populations by apex predators. The only exceptions involved species with specialized defenses, such as skunks or those that use specialized structural niches, such as arboreal behavior. Apex predators can affect mesopredator abundance through killing (and sometimes eating) them; through forcing behavioral shifts in foraging or use of habitats in time and space; and through direct aggressive interactions. These changes can have effects on population growth, predation rates, fitness, and survival. Bottom-up effects of vegetation productivity and community composition and distribution can affect abundance of species at all trophic levels, including IGP, attenuating or exacerbating the nature, strength, and direction of interactions among species (Thompson and Gese 2007, Ritchie and Johnson 2009). Apex predators may be more effective in controlling mesopredators in productive ecosystems (Ritchie and Johnson 2009).

In another commonly cited meta-analysis, Brashares et al. (2010) found evidence that MPR is a common result of the loss of apex predators in many systems throughout the world. Many current apex predators in some systems are exotic or invasive species. Loss of apex predators may or may not result in MPR, depending on the context. Additionally, increased abundance of mesopredators may or may not cause prey populations to decline, with mesopredators gaining dominance in areas of low productivity and high habitat fragmentation, and apex predators having more resilience in areas with high productivity and low habitat fragmentation. If a high diversity of apex and mesopredators consume a wide variety of prey, the potential for MPR and trophic cascades is weakened. Challenges in detecting MPR is difficult because of short duration studies, inherent natural variation, complex interactions among trophic levels, and researchers often invoke MPR when the apex predator has already been extirpated.

Another recent meta-analysis conducted by Ripple et al. (2013) suggested that any MPR effects due to wolves could be dependent on the context, and may be influenced by bottom-up factors, such as the productivity of a system without wolves. Factors such as human-provided food subsidies, scavenging opportunities on livestock and large ungulates, and existence of alternative prey may confound results. The authors suggest that a link exists between wolf population declines and expansion in the ecological influence of coyotes. The strength of any trophic cascade created by wolf recolonization may be dependent on whether wolf populations may reach ecologically-effective densities (also suggested by Letnic et al. (2007)), the amount of unfragmented habitat available, levels of wolf harvests and removals, and presence of refugia and food subsidies available to coyotes.

In Australia, researchers have suggested that widespread and intensive control of dingoes using aerial distribution of 1080-poisoned baits has resulted in releases of mesopredators, especially introduced foxes and cats (Letnic et al. 2007, Wallach et al. 2008, Brook et al. 2012), although Allen et al. (2014) argues that other plausible explanations may exist. Letnic et al. (2007) suggested factors that may also limit the control of dingoes on foxes include the abundance of prey (particularly introduced rabbits), seasonal activity patterns, levels of site and vegetation productivity, predator control regimes used, human food subsidies, and reproductive rates. Importantly, the authors argue that it is possible that top predators can ecologically express control over mesopredator populations only when apex predator population densities reach a certain threshold (also suggested by Ripple et al. 2013), which is likely to be above that at which apex predators pose a threat to livestock of human safety. Lack of human tolerance to predators may not allow that ecological threshold of abundance to be reached.

Similarly, Newsome et al. (2017) found that top predators suppressed mesopredators in areas where top predator densities were highest (core area), supporting the notion that removal of top predators can cause MPR. At areas outside the top predators core area, mesopredators and top predators have been shown to coexist, indicating that MPR may not occur when top predators are removed in those areas since mesopredators already had a realized ecological role. However, there is uncertainty with their results, since mesopredators could coexist in the high density core of a top predator's territory, but those individual animals are thought to be difficult to detect. The authors note that abiotic factors, such as human disturbance and agriculture, caused both top predators and mesopredators to be absent from the area, dampening the strength of top-down forces enough to create a bottom-up driven system.

Wallach et al. (2008) suggest that dingoes originally coexisted with two endangered species (a ground-nesting bird and a rock-wallaby), and extensive dingo baiting may be the unintended cause of Australia's extinction crisis due to MPR of introduced foxes and cats. Intensively baited dingoes may have managed to preserve pack cohesiveness due to learned behavior in response to human persecution, including becoming difficult to sample and highly secretive in areas of human presence and where they were expected to be exterminated. After intensive baiting of dingoes, endangered species may either crash (which is improperly attributed to the baiting program) or exhibit an exponential increase followed by a crash after a lag period (mesopredator populations increase during the lag period before adversely affecting the population of the endangered species). Brook et al. (2012) found evidence that controlled dingo populations hunted less at dusk (dusk being their common hunting period concurrent with prey activity), and therefore feral cats hunted more at dusk with higher efficiency. Cats may also have the additional behavioral advantage of climbing trees both to access prey and avoid predation by dingoes. Dingo densities may actually increase for a time following intense baiting due to dispersal of young dingoes.

Allen et al. (2013) demonstrated that the removal of dingoes did not result in increased mesopredator abundance. Further, Allen et al. (2014) argues that three often-cited studies purporting to provide evidence of MPR in Australia are actually plagued by imprecise sampling of predator populations. Additionally, none of the studies provide reliable evidence of MPR because there was no verification of reduced dingo populations due to baiting. The authors assert that, despite broad patterns of MPR demonstrations in some contexts, MPR cannot be reliably separated from other equally plausible explanations for the suggested interrelationships among dingoes, foxes, and cats. Additional research by Allen et al. (2018) has indicated that bottom-up effects (habitat and food availability) have a greater influence on hopping-mice (prey item of mesopredators) than the abundance of dingoes.

What is the Relationship of Adaptive Behavior, Resource Partitioning, and Human Subsidies to the Potential for Terrestrial Trophic Cascades?

Adaptive Behavior

Since the late 1990s, researchers have recognized that individuals and groups of herbivorous and/or carnivorous prey animals use behavior that may be evolutionary-based or learned as part of a social system to reduce the risk of predation. Other non-consumptive and abiotic factors such as snowpack, system productivity, rainfall, and climate change may also affect how predators and prey (including predators as prey, or IGP) interact (Peckarsky et al. 2008). Although top predators will kill smaller predators, other factors, including behavioral responses such as shifting territories, adapting anti-predator behavior, and resource partitioning, are the primary mechanisms by which dominant predators can limit smaller predator populations (Casanovas et al. 2012).

Berger-Tal et al. (2010) suggest that adaptive behavior by predators and prey should be integrated into models of conservation theory, and recognize the role that human behavior plays in impacting animal behavior, such as overharvesting, habitat fragmentation, disturbance, and the introduction of exotic species. The key animal behaviors affecting survival, reproduction, and recruitment are changes in movements and use of space, behaviors related to foraging and avoidance of predation, and social behaviors.

Gese (1999) reported that elk and bison act more aggressively toward the alpha pair of wolves than toward betas and juveniles. Female elk with young act more aggressively toward predators than males to determine the most effective level of anti-predator behavior with the least use of energy (Gese 1999), perhaps responding to behavioral clues emitted by the predators themselves (Peckarsky et al. 2008). The type of hunting style use by different terrestrial large predators, such as "coursing" versus "sit-and-wait" may cause different anti-predator responses by prey. For example, it may be easier to respond with less energy to coursing predators, such as wolves and coyotes, because it is easier to know if they are present or absent from an area than an animal that may be hiding and waiting for prey to mistakenly enter their attack range (Schmitz et al. 2004, Ritchie and Johnson 2009). However, Orrock et al. (2010), working primarily with fish and invertebrates, suggested that predators may change prey movements and behavior by "remote threat," even when the predator is not present (the predator causing a threat has been called a "keystone intimidator" by Peckarsky et al. 2008).

It is difficult to interpret the rationale for certain wildlife behaviors. Creel and Winnie (2005) disagreed with Hebblewhite and Pletcher's (2002) interpretation of elk grouping behavior near and far from cover. The latter interpreted elk foraging in meadows as a means to avoid predator attacks emerging from cover, the former reinterpreted the same behavior as release from anti-predator behavior when the short-term risk of predation was low, providing an opportunity for foraging in the best habitats. Creel and Winnie (2005) suggested that elk can assess temporal variations in predation risk on a sufficiently fine scale to determine the daily comings and goings of wolves through the senses, patterns of predator presence, and/or distribution of prey carcasses.

Prey may change their behavior to avoid chronic predation, including by humans, by changing the timing of activity (temporal behavioral change during the day or night) or the how they use the available habitat spatially in relation to the activity of the larger predator (Kitchen et al. 2000, Wilson et al. 2010). For example, Kitchen et al. (2000) reported coyote populations being significantly more active during the time period when predators are not (for coyotes, more active during the night while their eyesight is more adapted for optimal hunting during the day or dawn). Social animals may also be forced into behavioral and associated physiological changes under heavy human predation. Wallach et al. (2009) asserted that heavy predator control against dingoes (wolf-like canid) in Australia through aerial 1080 baiting fractured the social structure of packs, leading to changes in age composition, group size, survival rates, hunting abilities, territory size and stability, and genetic identity and diversity. When heavily controlled, dingoes learned to survive in areas deep in reserves and, conversely, directly near humans, livestock and areas of heavy baiting, utilizing additional food sources and passing on the anti-predator/human behavior to offspring.

Free-ranging domestic dogs were found to control distribution and habitat use of a small wild deer in South America due to high potential for harassment and attacks and resulting high lethality of attacks. Recreational hunting by subsidized domestic predators can cause behavioral and habitat shifts, reduction in fitness, and populations declines (Silva-Rodríguez and Sieving 2012).

Other important behaviors affecting the role of species abundance and recovery within trophic systems is dispersal, immigration into and out of a system or population, and territoriality. In species with social structures, such as wolves, dingoes, and coyotes, dispersal by beta and juvenile individuals may be due to little interaction with other pack members, lack of breeding opportunities, restriction to food resources by higher ranking members, and increased social aggressions from more dominant pack members (Gese et al. 1996, Gese 1996). Territories are areas that are defended from emigration by individuals that are not pack members, usually by the dominant pair, to limit or exclude competition for mates, food, and space (Gese 1998). Berger and Gese (2007) suggested that differential effects of wolf competition with coyotes on transient coyote survival and dispersal are important mechanisms by which wolves reduce coyote densities.

A challenge to interpreting the role of adaptive behaviors and other non-consumptive traits such as habitat or temporal shifts that are acquired over evolutionary time is that, when evaluating statistical correlations, these factors may have the same sign as consumptive factors (factors related to trophic interrelationships), moving in the same direction, so they may be overlooked or masked. Conversely, adaptive behaviors may also potentially increase the magnitude of trophic cascades that would otherwise be mediated by consumption. Non-consumptive effects may also be easily interpreted as bottom-up effects, or be considered as an afterthought to explain observations inconsistent with consumption-based theory, further confounding interpretation of study results (Peckarsky et al. 2008).

Resource Partitioning

Partitioning of resources in time and space are key behavioral methods for coexisting and minimizing competition between predators and prey, including predators that kill and/or eat other predators (IGP). Polis et al. (1989) identified **interference competition** (also called **competitive exclusion**; Arjo et al. 2002, Finke and Denno 2005, Brook et al. 2012), in which taxa in a community use similar diets and/or space and one interferes with the ability of the other to optimize the use of such resources. For example, hungry consumers may have greater movement in search of food, encountering predators or prey more frequently. Behavioral adaptations to minimize the risk of prey encountering predators can involve switching the use of habitats by using them at a time when it is likely that the predator would not be present (Palomares et al. 1996, Finke and Denno 2005, Hunter and Caro 2008) or switching their diet to minimize competition (Schmitz et al. 2004, Thompson and Gese 2007, Elbroch et al. 2015).

Several authors have reported that coyotes may eat smaller prey compared to wolves (such as deer, rabbits, or rodents rather than elk), while at the same time obtaining food directly provided by wolves through scavenging on large carcasses that the wolf pack cannot completely consume, such as elk and moose (Paquet 1992, Wilmers et al. 2003). Prior to wolf reintroduction in Yellowstone NP, coyotes depended on small mammals and scavenging carcasses late in the winter season, when animals were naturally weakened and died (Gese 1996, Wilmers et al. 2003). However, after wolves are reintroduced or they recolonize an area after extirpation, carcasses are provided throughout the winter, making direct interaction with wolves at a carcass, despite increased aggression and the risk of being killed, more energetically efficient than hunting (Arjo et al. 2002, Atwood et al. 2006, Thomson and Gese 2007, Wilmers et al. 2003). Food subsidies provided by scavenging introduces complexity into food webs. In Rocky Mountain National Park, over 30 species of mammalian and avian scavengers use wolf kills (Wilmers et al. 2003).

After reintroduction of wolves into Yellowstone NP, competition between mountain lions and wolves suggested that mountain lions significantly increased the proportion of deer in their summer diet and decreased the proportion of elk. Both wolves and mountain lions predated on elk calves in the summer, but elk had shifted their winter range to irrigated fields outside the park, as well as institutionalized winter feeding subsidies. This resulted in elk populations no longer being limited by natural carrying capacity, so neither wolf nor elk were limited in the summer by elk calf availability (Elbroch et al. 2015).

Atwood et al. (2006) found that mountain lions and wolves ate the same prey (elk) but in different habitats. Female mountain lions select habitat based on opportunities for hunting more than male mountain lions do. Lendrum et al. (2014) suggest that competition with reintroduced wolves in Yellowstone NP caused mountain lions to select habitat removed from known wolf pack territories and with buffers to reduce the potential for interactions with wolves. Avoiding wolves may result in use of less optimal habitat, especially for female mountain lions, which may have implications for survival of dispersing juvenile mountain lions and overall mountain lion dynamics.

Swift and kit foxes, closely related foxes that are much smaller than coyotes, are often killed by coyotes in areas where their home ranges overlap (Kamler et al. 2003, Moehrenschlager et al. 2007, Kozlowski et al. 2008); however, fox populations having higher survival rates tended to use portions of the overlapping home ranges that had more heterogenity, especially areas providing burrow and den refugia that allow rapid escape from coyotes. Home range sizes decreased as the availability of burrows increased, as it did in areas with lower shrub densities in which predators can be readily viewed and escaped more quickly (Moehrenschlager et al. 2007, Kozlowski et al. 2008).

More than body size and behavior, especially in non-canid mammalian predators, may cause resource partitioning. Even when raccoon and coyote home ranges overlapped, researchers found little evidence of coyotes killing raccoons, and little evidence that raccoons avoided coyotes. Since raccoons are opportunistic omnivores, there is little potential for direct competition. Raccoons also climb trees, which may provide a structural habitat partitioning (Gehrt and Prange 2006). Skunks avoid direct predation by larger carnivores through distinctive coloration and toxic emissions (Hunter and Caro 2008, Ritchie and Johnson 2009).

Human influence on habitat use, especially habitat fragmentation, human activity, and human food subsidies, is an important consideration for how individuals and populations interact and thrive (Litvaitis and Villafuerte 1996, Palomares et al. 1996, Fedriani et al. 2000, Fischer et al. 2012).

Human Food Subsidies

A review of the literature by Newsome et al. (2015) found that 36 terrestrial species in 34 countries used food provided by humans, such as discarded food, livestock carcasses, crops, and landscaping. With such subsidies, predator abundance increased (no longer limited by resources), diets were altered to include human-provided food, survival increased, and social interactions shifted to either the benefit or disadvantage of the predator. Predators also changed their home ranges, activity, and movements. Subsidies can result in induced behavioral or population changes and may result in trophic cascades, causing predator populations to no longer cycle with prey cycles. Top predators used primarily livestock, mesopredators used livestock carcasses and waste food, cats continued to use live prey, and bears mostly used crops, waste foods, and carcasses. Prey also used human presence and activities as shields from predators in some cases.

Fedriani et al. (2000) found that areas in southern California with high and patchy human residential development provided sufficient human food subsidies through trash, landfills, livestock, and domestic fruit, as well as providing subsidized habitat for rabbits. The study also found that coyote densities were eight times higher than in more natural areas (also, Fischer et al. 2012). As predator size increases, human tolerance tends to decrease (Fischer et al. 2012).

In urban areas, coyotes tended to avoid urban and crop areas, using safer corridors between patches of forest areas used for cover during the day and hunting (Arim and Marquet 2004, Gehrt et al. 2009). Gehrt et al. (2009) found mostly "invisible" coyotes avoiding humans and human-provided food in core areas of downtown Chicago and at O'Hare International Airport (similar to Wallach et al. 2008, Wallach et al. 2009). Raccoons, however, heavily used dumpsters and trashcans at night in areas with high human activity during the day (Gehrt et al. 2009). Bino et al. (2010) found that foxes, when human food subsidies were rapidly removed, responded by increasing or shifting their home ranges or dispersing from the area, and that fox densities in the urban area decreased substantially within a year.

How Do Predator Population and Social Dynamics Affect Ecosystem Structure and Function?

The territory of an animal has been defined as the area that an animal will defend against individuals of the same species (Mech 1970, in: Gese 1998). Since the Knowlton and Stoddart (1983) study (and further clarified by Gese 1998), it is clear that the territorial alpha pair is the basic unit of wolf and coyote populations. According to Gese (1998), the alpha pair is responsible for monitoring and defending the territory and its resources from other conspecific predators from adjacent packs through patrolling and scent marking. Pack size varies geographically, with wolf packs more commonly composed of more individuals than coyote groups. Ecologically, the socially intact and operating wolf pack, not individual animals or even the alpha pair, is the unit that appears to control the structure and function of the ecological system (Wallach et al. 2009).

Maintaining the structure of the pack is critical for ensuring that the pack has the needed resources through shared hunting strategies and scavenging, collaborative care of the alpha pair's young, and learned behavior of the young for hunting efficiency and wariness of novel changes in the territory. In coyotes, only the alpha pair breeds and only 10% of the young from a given pair need to survive and reproduce to replace the pair. The remaining 90% of the beta (subdominant) and transient animals either stay in the pack without reproducing, die, or disperse, and often die before establishment in a new territory (Knowlton et al. 1999). Therefore, in the absence of human hunting, territories and associated population densities tend to remain relatively stable over time.

Population control of socially complex species like wolves may have profound ecological impacts that remain largely invisible if only abundance is considered. Heavy predator control (in this case intensive aerial baiting of dingoes with 1080) can seriously fracture pack social structure, leading to changes in age composition, group size, survival rates, hunting abilities, territory size and stability, social behavior, genetic identify, and diversity. Controlled populations tend to have a higher proportion of young breeding pairs and litters due to loss of dominant adults in the pack structure controlling access to breeding. Packs may disperse after the loss of the breeding pair and territory boundaries may weaken or dissolve, creating transient individuals that are more vulnerable to predation. The pack may also shift to another area under heavy exploitation and breakup of territories. Learned and practiced coordinated hunting behaviors within packs may be lost due to loss of social structure and changes to social traditions. A symptom of pack disintegration may be a decreased ability to take down larger prey and predators may shift to smaller and or more vulnerable prey. Smaller packs may reduce success at scavenging in the winter due to competition from larger predators. Intensive human removals may teach remaining animals to be highly secretive (Wallach et al. 2009).

Studies suggest that coyote territories do not remain vacant for very long after members are removed. Gese (1998) noted that adjacent coyote packs adjusted territorial boundaries following social disruption in a neighboring pack, thus allowing for complete occupancy of the area within a few weeks, despite removal of breeding coyotes. Blejwas et al. (2002) noted that a replacement pair of coyotes occupied a territory in approximately 43 days following the removal of the alpha territorial pair. Williams et al. (2003) suggested that temporal genetic variation in coyote populations experiencing high predator removal indicated that localized removal did not negatively impact population size. Gese (2005) found that after heavy removal rates (populations reduced between 44% and 61% over two years) there was a younger age structure in packs and increased reproduction by yearlings, with pack size and density rebounding to pre-removal levels within eight months post-removal. The author attributed some of the response to immigration of animals from outside the territory and increased lagomorph prey availability that apparently increased mean litter size in both the removal and control areas. Young animals, which are low in the social structure and subjected to lower resource accessibility, and some betas with no potential for becoming breeding alpha members of the pack, generally disperse (Gese et al. 1996), which may also keep genetic diversity high as dispersing animals fill vacated openings within another pack.

While it is true that wolf removal can have a short-term disruptive impact on pack structure, that disruption does not appear to result in adverse impact on the overall wolf population (Nadeau et al. 2008, Nadeau et al. 2009, Mack et al. 2010). Pack resilience to mortality is inherent in wolf behavioral adaptation and reproductive capabilities (Brainerd et al. 2008). Based on mean pack size of eight, mean litter size of five, and 38% pups in packs, Boertje and Stephenson (1992) suggested 42% of juveniles and 36% of adults must be removed annually to achieve population stability. Researchers have indicated declines may occur with human-caused mortality at 40% or less of autumn wolf populations (Peterson et al. 1984, Ballard et al. 1997).

The data on wolf mortality rates suggest some wolf populations tend to compensate for losses and return to pre-removal levels rapidly, potentially within a year. Wolf populations have sustained human-caused mortality rates of 30% to 50% without experiencing declines in abundance (Fuller et al. 2003). In addition, Brainerd et al. (2008) found that 62% of packs in recovering populations retained territories despite breeder loss. Furthermore, pup survival was primarily dependent on size of pack and age of pup because multiple pack members feed pups despite loss of an alpha breeder. Pup survival in 84% of packs with breeder loss was similar or higher than packs without breeder loss (Mech and Boitani 2003).

Wolves and coyotes with strong social structures can be resilient in the face of moderate levels of exploitation, and can recover abundance relatively rapidly. However it is not known at what population densities these species can exert top-down control through the ecosystem. Many populations are simply too small to actually cause top-down trophic cascades (Ray et al. 2005, Letnic et al. 2007, Ripple et al. 2013).

What is the Relationship of Trophic Cascades to Ecological Biodiversity and Ecosystem Function?

Humans are the top predator in all systems, but the roles humans play as predator in trophic cascades, biodiversity, and ecosystem function are rarely considered (Ray et al. 2005). Most predators cannot directly and intentionally change their habitats and condition to serve their own purposes; only humans can do that.

Humans are altering the composition, ecosystem structures, and impacted diversity of biological communities through a variety of activities, such as logging, agriculture, grazing, development, climate change, loss of native species and additions of exotic or invasive species, with new functions that increase the rates of species invasions and extinctions, at all scales. Many human-altered ecosystems are difficult and expensive to recover, or may be impossible to reverse (Hooper et al. 2005, Ritchie et al. 2012). Biodiversity is declining a thousand times faster now than at rates found in the fossil record, and is becoming increasingly confined to formally protected areas, which may fail to function as intended due to size and lack of connectivity to other protected areas (Balvanera et al. 2006, Estes et al. 2011). Concern is growing that the loss of ecosystem services provided by biodiversity are adversely impacting human well-being (Hooper 2005, Balvanera et al. 2006, Cleland 2011).

Despite compelling experimental evidence, the relationship of biodiversity to ecosystem functioning and provision of ecological services has great uncertainty and is still contentious among researchers because the differences in experimental design, the results obtained, and interpretations of those results have not been consistent or universally accepted among the research community (Balvanera et al. 2006, Hooper et al. 2005).

Biodiversity can be described at many scales, from genetic to global (Hooper et al. 2005, Cleland 2011). Biodiversity can be measured in many ways as well, including **species richness** (the number of species in a system), richness of functional groups (the number of ecological functions performed by groups of species in a system), **evenness** (the distribution of species or functional groups across the system), species composition (the identity of species occurring in the system), and diversity indices (comparative measures, using whatever factors are measured). Typically, biodiversity is measured in terms of species richness, because it can be readily measured and compared, but that measurement ignores the complex interactions among species, population, communities, and abiotic factors (Ray et al. 2005, Balvanera et al. 2006, Cleland 2011).

The five top reasons for losses of biodiversity are human-caused habitat loss, fragmentation, and conversion; climate change; introduction of invasive and exotic species; pollution and nutrient enrichment (such as additions of farm fertilizers to aquatic systems); and overharvesting (Srivasta and Vellend 2005). However, these effects can be mediated to a degree by immigration and dispersal (France and Duffy 2006). The effects of biodiversity change in ecosystem processes are weaker at the ecosystem level than at the community level, and have a negative correlation at the population level (Balvanera et al. 2006).

Four mechanisms that account for biodiversity can influence the combined densities of predators and prey and their resources: sampling effects; resource partitioning; indirect effects caused by IGP, including diverse ecosystems with multi-trophic levels and multiple indirect effects; and non-additive effects resulting from consumers with non-linear complex functional responses (Ives et al. 2005).

Biodiversity can enhance the reliability and stability of ecosystem services and functions through more diverse communities and spatial heterogeneity (France and Duffy 2006). **Ecosystem stability** is defined as a system that changes little, even when disturbed; **ecological resilience** is defined as a system that, when perturbed, can recover to its original stasis (Cleland 2011). Ecosystems with low biodiversity have low resilience and are sensitive to disruptions, including perturbations caused by humans (Ritchie et al. 2012). Having a variety of species, including top predators, which responds differently to environmental perturbations can stabilize ecosystem processes (Hooper et al. 2005, Duffy et al. 2007).

Ecosystem functioning is a broad term that encompasses a variety of processes and reflects how the interrelated ecosystems involving biotic and abiotic factors work together. It depends on biodiversity and is the basis of the capability of the ecosystem to provide ecological services of value to humans (Hooper et al. 2005). Variation in ecosystem functions and processes can result from natural annual environmental fluctuations, directional correlational changes in conditions, and abiotic and biotic disturbances (Hooper et al. 2005).

Functional redundancy of species refers to the degree to which organisms do similar things within a system and that one species can potentially compensate for the loss of another (Hooper et al. 2005, Casula et al. 2006, Cleland 2011). A relevant example of lack of functional redundancy involves human hunting (with human as the top predator) and natural predation. Human hunting cannot replace the roles that top predators play because the timing and intensity of predation is different; different age and sex classes are targeted; hunting does not generally result in impacts to mesopredators; trapping can result in take of non-target animals; hunting requires infrastructure such as roads that have effects on animals and vegetation (such as mortality caused by collisions with vehicles). In many cases, human hunting and poaching are unsustainable in many parts of the world (Ray et al. 2005).

It is suspected that greater variations in response to changes in biodiversity occur than is reported in the literature, based on inherent complexities associated with variations in prey use patterns, prey use rates by predators, predator abundance, and predator-prey distributions and interactions. This complexity results in many plausible theoretical explanations for results obtained by modeling biodiversity (Casula et al. 2006), none of which are certain. Studies incorporating multi-trophic levels that more realistically reflect nature and that consider interrelationships are still rare in this discipline (Hooper et al. 2005).

Ecosystem services are the conditions and processes through which natural ecosystems and the species that comprise them sustain and fulfill human life, including purification of air and water, support of soil fertility, decomposing waste, climate regulation, pollination, regulation of pests and human diseases, creating conditions of aesthetic beauty, and maintenance of biodiversity (Srivasta and Vellend 2005, Balvanera et al. 2006). As human populations increase and human domination of the biosphere expands, managing ecosystems for human services will become increasingly important to prevent shortages of water, energy, and food, while attempting to decrease disease and war (Kremen 2005).

Substantial theoretical and empirical evidence exists that biodiversity is able to effect ecosystem function for plant communities, but it is not clear if these patterns hold for conditions involving large predator extinctions, multi-trophic communities, or larger spatial scales (Loreau et al. 2001, Ray et al. 2005, Srivasta and Vellend 2005). The major challenge is to determine how the dynamics of biodiversity, ecosystem function, and abiotic factors interact, especially with steadily increasing human-caused ecosystem degradations. Considering factors other than species abundance and richness (the number of species occurring in an ecosystem and the number of animals in each species), a more predictive science might be achieved if researchers developed an appropriate classification of ecosystem function integrating changes in biodiversity, ecosystem function, and abiotic factors into a single, unified theory that can be empirically tested (Loreau et al. 2001). This is extremely difficult to develop.

Understanding how biodiversity affects ecosystem function requires integrating diversity within trophic levels horizontally and across trophic levels vertically. Multi-trophic interactions may produce a richer variety of diversity and functioning relationships, depending on the degree of dietary generalization and specialization, trade-offs between competitive ability and resistance to predation, IGP, and immigration/dispersal. Little is known about how reducing the number of trophic levels or species or removing predator species affects ecosystem processes. Integrating more mobile large carnivores into research is an especially difficult challenge empirically (Duffy et al. 2007).

Experiments are often conducted at small scales with insufficient duration to account for turnover of the components in order to provide evidence for true change (as opposed to inherent natural variation), and biodiversity often includes exotic and invasive species. The effects of biodiversity on ecosystem function depend on the system being studied and the functions that are sampled and measured. Few studies have been conducted considering interactive effects of extinctions between two trophic levels, and those studies have mixed results (Srivasta and Velland 2005).

Srivasta and Vellend (2005) conclude that biodiversity is declining at global scales, but the scales at which empirical studies are being conducted are not scaled up to appropriate levels to reflect nature. The results of studies are inconsistent on whether biodiversity has positive effects on ecosystem function, especially because it is not known how these studies are being scaled up; ecosystem effects of extinctions in multi-trophic food webs are difficult to predict because of numerous and complex indirect effects and the likelihood of simultaneous or cascading extinctions through the trophic levels; and human-caused drivers of extinction effect ecosystem function to a large magnitude directly and indirectly.

Decreases in biodiversity often lead to reductions in ecosystem functions, then in the resultant ecosystem services. Declines in providing services are initially slow, but become more rapid as species from higher trophic levels are lost at faster rates. Different ecosystem services respond differently to losses of habitat and biodiversity, introductions of exotic or invasive species, and the variety of interactions among species within and between trophic levels. Because different ecosystem services tend to be performed by species at different trophic levels, and trophic webs tend to first thin before collapsing from top to bottom, the processes should be predictable and foreseeable. The best way to address biodiversity and ecosystem function is to ensure that the ecosystems remain viable for species with larger area requirements that tend to have less readily identifiable economic value, such as large carnivores (Dobson et al. 2006).

Sustainable and healthy populations of large predators have the potential to restore ecosystem stability and confer resiliency against global processes, including climate change and biological invasions (Duffy et al. 2007). Because the roles of predators are dependent on their context, the emphasis of research must be more focused on predator functions in ecosystems, including the importance of social structures and adaptive behaviors in influencing the dynamics of trophic interactions, and less on the identities and abundance of species. There is great variability and uncertainty surrounding the ecological functions of predators, including unpredictable and even counter-intuitive outcomes that may be caused by species interactions such as IGP and mesopredator release (Ritchie et al. 2012). However, it is inappropriate to assume that the mere presence of large carnivores ensures persistence of biodiversity (Ray et al. 2005).

The first species that tends to be lost or rendered ecologically extinct in both terrestrial and marine systems is almost invariably the large carnivorous predator, primarily due to their intrinsic rarity at the top of the trophic web, small population sizes, restricted geographic ranges, generally slow population growth rates, and specialized ecological habits. Top predators are especially vulnerable to human-caused habitat destruction and fragmentation, as well as exploitation and persecution due to conflicts with humans (Duffy 2003). Humans, as the top predator, have eliminated the largest predators from over 90% of the Earth, globally extinguishing ecological functions (Pace 1999, Ray et al. 2005).

Evidence suggests that the loss of one or more large carnivorous predator species often has impacts comparable in magnitude to impacts associated with a large reduction in plant diversity. This results in large changes in community organization, ecosystem properties and system functions (Duffy 2003). Apex predators tend to be the determinants of biodiversity structure and function, and the most challenging to conserve (Ray et al. 2005). Studying the results of the impacts of the loss of large carnivores on the structure and function of ecosystems is extremely difficult because of a complexity in trophic interactions. Evidence from ecological studies indicate that the largest contribution of changes in biodiversity on ecosystem function occurs when humans introduce exotic or invasive plant and/or animal species, which may increase the number of species in a system (species richness), while reducing ecosystem functions. Biodiversity will continue to erode under human influence (Duffy 2003).

Despite increasing research on the tangled complexity of food webs and trophic interactions, we have no better understanding of how to apply the results to conserving biodiversity and ecosystem function. Marine ecosystem cascades are generally caused by overexploitation of species eaten by humans; in terrestrial ecosystems, changes in biodiversity are generally caused by human-caused habitat destruction, fragmentation, and conversion. Large carnivores are generally not specialized in function or diet, so pristine conditions are not needed for survival; large carnivores are mostly resilient in the face of human perturbations, provided they have their basic baseline conditions. The primary problem with restoring large carnivores is competition with humans for space, resources, and property such as livestock (Ray et al. 2005), which can often lead to legal and illegal removals, concerns with human health and safety, and further pressures on endangered species (Ritchie et al. 2012).

Biodiversity, broadly defined, and the roles of large predators potentially contributing to biodiversity, clearly has strong effects on ecosystem functioning and provision of ecosystem services, which must be communicated to those charged with economic and policy decision-making to avoid ineffective and costly management actions (Hooper et al. 2005).

However, researchers have identified the need for consideration of ecological complexities in study designs for better determining true levels of biodiversity and their roles within ecosystems, including factors such as resource partitioning, indirect and additive effects (including IGP and MPR), multiple effects, social stability of packs of socially complex top predators, and multi-trophic systems. Studies must also be upscaled to more realistically represent larger systems, the results of which may then overturn the more general findings of the current studies of simplified systems (Ives et al. 2005, Srivasta and Vellend 2005, Wallach et al. 2009). More studies are also needed on the sequence of system collapse and replacement of ecosystem services as systems are further degraded (Dobson et al. 2006). The ecological roles of predators in supporting ecosystem biodiversity and functions and providing ecosystem services to humans are substantially unknown.

What Should Be the Role of Top Predators in Conservation Plans?

Predator management is characterized by complex ecological, economic, and social tradeoffs that are often not readily apparent or mutually exclusive, as well as being very expensive. Large carnivore conservation is impeded because much of the habitat is already destroyed or has uses that conflict with predators, they can be perceived to be threatening to human safety, and they kill game species and livestock (Prugh et al. 2009, McShane et al. 2011, Ritchie et al. 2012). Replicating the full suite of influences provided by apex predators is exceptionally challenging if not impossible.

The ability to better predict mesopredator responses to reintroduction or gradual recolonization of apex predators would enhance effectiveness of management efforts. The daunting task of conservation of top predators requires substantial habitat restoration, greater public acceptance of large carnivores, and compromises among people most directly affected by these predators (Prugh et al. 2009). Also, little is known about the impact of trophic interactions, particularly predator-prey and predator-predator interactions on the relationship of biodiversity and ecosystem functioning in natural systems. Increasing predator diversity could promote trophic cascades if predator species act additively or hide trophic cascades if IGP is likely to occur in diverse predator assemblages (Finke and Denno 2005).

Because top predators need lots of room, have symbolic value, and can structure ecosystems under certain circumstances, they have the potential to gain public support for conservation programs to achieve higher scale conservation goals to restore degraded ecosystems. Large scale conservation should not be confused with the ecological roles and importance of apex predators to conservation. In areas where top predators were extirpated but the system was protected, such as in national parks, top predators may be effective in improving biodiversity and ecosystem function.

In areas with high levels of human-caused habitat change, development, and relatively unlimited prey (large populations of deer), gradual recolonization by top predators, such as by wolves in the northern Midwestern US, often increase the potential for conflicts with humans. The ability of top predators to reach a threshold density to play an ecological role for conservation may be limited by population reductions in response to human conflicts, including in areas surrounding reserves. The conservation goal must focus on reaching population levels and distribution of top predators that the threshold for creating ecological structure is reached and sustained (Ray et al. 2005, Letnic 2007, Ripple et al. 2013).

The best chances for using top predators for conservation purposes is where the extirpation of predators has been clearly shown to result in adverse ecosystem impacts and where the system has not been degraded by other factors. In terrestrial systems, where habitat conversion has created so many changes to biodiversity, the return of top predators may require long periods of time to reach conservation objectives, if recovery can be achieved at all (Ray et al. 2005).

The precautionary principle when designing conservation plans is important, shifting the burden of proof to those who discount the ecological role of predation, because thresholds of change may result in large and sudden phase shifts that may be impossible to reverse (Ray et al. 2005, Estes et al. 2011).

The most important questions regarding conservation of large predators, biodiversity, and ecosystem function remain unanswered:

1. In what locations and under what conditions to large carnivores play an ecologically significant role?

2. In what locations and under what conditions would restoration of large carnivores result in restoration of biodiversity?

3. What densities of large carnivores are necessary to produce the desired restoration of biodiversity?

4. What are the interactions between hunting by carnivores and hunting by humans? (Ray et al. 2005).

What are the Challenges Associated with Interpreting and Applying the Results from Studies Conducted in Different Ecosystems?

Regardless of the context, Litvaitis and Villafuerte (1996) warn researchers not to confuse declines in apex predators and changes in lower trophic level species abundance as a cause-and-effect relationship, as both are likely a response to human activity, including collisions with vehicles, legal and illegal take, habitat fragmentation, development, and/or human subsidies. Interpretations of results must look for factors beyond those naturally occurring in the study area.

A primary challenge to testing the presence and strength of a trophic cascade involves removing predators from systems in which they are abundant or adding them to systems where they are absent, creating an intended perturbation that can be tested statistically (Estes et al. 2011, Ripple et al. 2016). With large free-ranging carnivores, intended removal of predators as part of a study is typically socially, ethically, and politically challenging or impossible (Ray et al. 2005, Estes et al. 2011). Therefore, many studies rely on areas in which large apex predators were extirpated and either reintroduced or rapidly recolonized the area, while the original conditions remain substantially the same, such as in older national parks, including Yellowstone National Park, Zion NP, and Banff NP (e.g., Heeblewhite et al. 2005, Ripple and Beschta 2006, Berger et al. 2008, Estes et al. 2011, Beschta and Ripple 2012, Ripple et al 2015).

Another challenge involved with conducting studies that provide statistically-strong results involves the temporal scale of the study, which must be of sufficient duration to incorporate the generation times of the component species, especially plants. While predator impacts have been observed over weeks and months in lakes, streams, and nearshore marine systems, decades or even centuries may be required for terrestrial systems where the base autotrophs may be shrubs or trees (Duffy 2003, Schmitz et al. 2004, Briggs and Borer 2005, Ripple et al. 2016, Engeman et al. 2017).

Relevant Publications Outlining Challenges

- **Ecosystems are more complex than first thought**: Pace (1999) suggested that cascades are more likely to be non-linear and food webs to be probabilistic due to highly variable conditions that promote and inhibit the transmission of the effects of predators on food webs (called trophic dynamics), including complicating and confounding factors such as differences in inherent primary productivity (the nutrition provided by the plant communities), adaptive predator-avoidance behavior, the potential for ecological compensation, and the availability of anti-predator refugia for prey. In other words, researchers began to understand that ecological interrelationships among biotic and abiotic components of ecosystems had blurred what had appeared to be clear boundaries and interconnections.
- **Top-down effects appear to dissipate faster on terrestrial ecosystems than in freshwater ecosystems:** Polis et al. (2000) suggest that this may be the result of aquatic systems better fitting the simplifying assumptions of trophic cascade models (such as incorporating discrete homogeneous environments and short regeneration periods for predators, and simple and trophically-stratified systems with strong and clearly identifiable interactions among species). They also

suggest that most terrestrial systems are more complex and heterogeneous, with fuzzy boundaries between trophic levels, having variable prey and predator dynamics, and weak and diffuse interactions between species (except in human-designed agricultural systems). Species that have greater defenses against predation or herbivory tend to become dominant, weakening the link between predators and prey. The authors argue that, even at the species level, support for the presence of trophic cascades is limited in terrestrial systems (also, Halah and Wise 2001). Conclusions about the strength of top-down effects may be an artifact of the plant-response being measured, not a response that actually exists in the environment. Schmitz et al. (2004), based on a meta-analysis, reports that a conclusion that a cascading effect may be weak or non-existent or existent and strong may be an artifact of the was the species in a system are categorized and aggregated by the researcher (for example, whether a species is a mesopredator or an apex predator, or which predator species feeds on which prey species), and the conclusion may be dependent on the system topology as conceptualized for the specific web.

- **Certain ecological dynamics that occur in terrestrial ecosystems may not occur in aquatic ecosystems:** The additions of the concepts of IGP (Section F.8.1) and mesopredator release (MPR; Section F.8.2), in addition to non-consumptive factors such as adaptive anti-predator behavior and beneficial foraging behavior (Section F.9) in the face of differing predation risk based on the type of predator hunting behavior ("coursing" compared to "sit-and-wait"), further complicate the concept of trophic cascades in heterogeneric terrestrial ecosystems with socially complex and wide-ranging predators and prey (Ripple et al. 2016).
- **Some effects, though appearing in both ecosystems, may be weaker in terrestrial ecosystems:** A meta-analysis of research papers conducted by Halah and Wise (2001) related to terrestrial arthropod-dominated food webs found extensive support for the presence of trophic cascades in terrestrial communities, but that the effects on biomass of primary producers are weaker in terrestrial communities than in aquatic food webs. A meta-analysis of 102 scientific publications across different types of ecosystems (lakes/ponds, marine, stream, lentic and marine plankton, and terrestrial agricultural and old fields) conducted by Shurin et al. (2002) reported high variability among ecological systems, and that predator effects were apparently strongest in benthic communities in lakes, ponds and marine ecosystems, and weakest in marine plankton and terrestrial food webs (also Borer et al. 2005). The complexity of terrestrial food webs within which large wide-ranging and adaptable carnivores are at the top of the web may further weaken the statistically observable presence of predator-driven effects (Halah and Wise 2001).
- **Tradeoff behavior may be specific to the type of ecosystem and may contribute to the variability in the nature and strength of cascading effects:** Schmitz et al. (2004) conducted a meta-analysis of 41 studies conducted in aquatic and terrestrial ecosystems that indicated that one mechanism addressing the uncertainty about the ultimate mechanisms driving trophic cascades may be

the trade-off behavior associated with prey avoiding the risk of predation while also attempting to forage optimally. Knowing the habitat and resource use by prey with regard to the presence of one or more predators, and the hunting mode of the predator ("coursing/patrolling" compared to "sit-and-wait") may help explain the considerable variability on the nature and strength of cascading effects among systems. Different hunting modes force prey to balance the energetic effects of reacting through vigilance, ceasing foraging and moving away, or exhibiting aggression. Prey responding to active, coursing predators may be the least risk averse, determining that foraging is more important than maintaining constant vigilance, especially later in the winter, when fitness is inherently reduced. Different predators apply different rules of engagement based on hunting mode and habitat use, which then drive adaptive behavioral responses and associated trophic effects (Schmitz et al. 2004, Peckarsky et al. 2008).

- **Studies may study small subsets of communities for short periods of time, making interpreting results difficult.** Borer et al. (2005) conducted a meta-analysis of 114 studies in terrestrial agricultural and grassland/shrub ecosystems mainly involving arthropods, lake, marine, and stream benthic communities. Of all the studies reviewed, only the marine benthic and grassland studies involved warm-blooded predators, and only one included a warm-blooded herbivore. The authors found evidence that the strongest cascades involved warm-blooded vertebrates (otters and humans), but these communities were primarily in marine environments. However, the authors reported that most studies only evaluate interactions within a small subset of a community, potentially resulting in too little variability in the species manipulated to detect relationships between diversity and the strength of cascades. Most studies were also of insufficient duration and study area size to actually detect ecological impacts that could be suggested to be different from inherent natural variability.

Challenges to Conducting and Interpreting Research and Modeling on Complex and Dynamic Ecological Systems

Many researchers and theoretical ecologists have identified the challenges associated with attempting to study and reach conclusions about very complex and interrelated systems. Ray et al. (2005) finds that determining the ecological effects of large carnivores on the biodiversity, structure, function, and dynamics of ecological systems and any associated ecosystem services may be highly challenging or even impossible to discern. Reasons provided by various researchers include:

- It is difficult to design suitable experiments with spatial and temporal dimensions that are appropriate for the species, populations, communities, and systems involved. This is especially difficult for large carnivore species that are wide-ranging and socially and behaviorally complex, and that use large heterogeneous integrated habitats that may change seasonally (for example, Ray et al. 2005, Ripple and Beschta 2006, Vance-Chalcraft et al. 2007, Engeman et al. 2017)
- Determining change in systems requires that perturbations be created and the results tested, with replications, which may be socially, morally, ethically, and

politically impossible with systems involving large carnivores (Ray et al. 2005, Estes et al. 2011)

- Baselines on which to compare changes to determine causal relationships are often already damaged or eliminated, with no remaining or known natural benchmarks against which to measure effects, restricting the ability to discern short-term and long-term equilibrium states with and without predators (Ray et al. 2005, Kozlowski et al. 2008, Estes et al. 2011)
- Finding matched comparison study areas that are sufficiently similar over large spatial areas and over a sufficiently large temporal duration may be difficult and costly at best, and realistically impossible (Ray et al. 2005)
- The existence of many confounding factors can make strong predictions about effects and causation impossible, including abiotic factors such as climate change; weather; differences in site and area productivity; naturally occurring environmental oscillations and "noise"; soil mineralization; and surface and subsurface hydrological dynamics (Ray et al. 2005, Ripple and Beschta 2006, Kauffman et al. 2010, Orrock et al. 2010, Miller et al. 2012, Ripple et al. 2013, Allen et al. 2014, Engeman et al. 2017)
- Human impacts are often discounted or are considered tangentially, despite their often dominant and pervasive influence (Vitousek et al. 1997, Estes et al. 2011), and can confound the ability to experimentally discern functional roles of predators, such as: human actions that have historical caused extirpations or extinctions; habitat fragmentation, especially by development and agriculture; introduction of livestock and/or exotic and invasive species into systems; hunting, poaching, persecution, and roadkill; human intolerance, especially of larger predators; human competition for prey of predators; depletion of prey needed by predators; providing food and structural subsidies; creating predator guilds made up of free-ranging carnivorous pets (cats and dogs) that are subsidized, are recreational killers, and often live in developments bordering large fragmented habitats with already stressed prey populations; and large-scale resource exploitation (for example, Ray et al. 2005, Livaitis and Villafuerte 1996, Palomares et al. 1996, Fedriani et al. 2000, Estes et al. 2011, Fischer et al. 2012, Allen et al. 2017, Haswell et al. 2017)
- Some potentially strong and important correlations related to non-consumptive factors that are in the same statistical direction as commonly recognized correlations may be masked and not considered in interpretation of study results (Peckarsky et al. 2008)
- Valid comparisons of studies evaluated in meta-analyses of multiple studies (where researchers review and reconsider the results of many studies to look for patterns and problems) have been difficult to make because of differences in spatial and/or temporal scale, differences in factors measured, differences in statistical methods and assumptions, and differences in study methodologies, among other reasons (Briggs and Borer 2005, Hooper et al. 2005, Vanec-Chalcraft et al. 2007, Brashares et al. 2010)

- Most models are oversimplifications of natural systems, and do not include complexities such as anti-predator behavior, more multi-trophic community models, and richer webs of interacting species across heterogeneous landscapes (for example, Holt and Huxel 2007)
- Much of the research related to trophic cascades is often conducted at a small scale and is of short duration in relation to the inherent biological characteristics of the species, communities, and populations (such as reproduction, immigration, generational turnover, or developing ecologically meaningful changes in abundance), and on species that are small, sessile, or localized and easily manipulated (adding or removing individual predator species or guilds), such as invertebrates, arthropods, localized fish populations, and plankton, and are typically in high productivity systems such as streams, lakes, and marine intertidal ecosystems (for example, Duffy 2003, Schmitz et al. 2004, Ray et al. 2005, Briggs and Borer 2005, Beschta and Ripple 2006, Brashares et al. 2010, Estes et al. 2011, Ritchie et al. 2012)
- Research conducted in small temporal and/or geographic scales is difficult or inappropriate to scale up or apply generally to large marine or terrestrial systems, especially for guilds involving wide-ranging, often socially complex predators (for example, bluefin tuna (*Thunnus thunnus*), sharks, wolves, dingoes, or coyotes) (for example, Schmitz et al. 2004, Ripple and Beschta 2006, Brashares et al. 2010, Engeman et al. 2017)
- Research in various systems is being published so rapidly in the last 20 years that it is difficult for researchers to be aware, let alone familiar with, that level of new research results ("information avalanche"), especially if the research is conducted on systems outside of their own disciplinary area (Sergio et al. 2014)
- Statistical analyses, assumptions, and interpretations of results are often appropriately re-evaluated and challenged by other researchers, yet the original papers are cited by other researchers without recognizing these challenges (for example, Ripple and Beschta 2006, Ripple and Beschta 2007, Kauffman et al. 2010, Painter et al. 2015, Litvaitis and Villafuerte 1996, Palomares et al. 1996, Hooper et al. 2005, Balvanera et al. 2006, Wielgus and Peebles 2014, Poudyal et al. 2016)
- The role of outbreaks of parasites and pathogens in ecosystem function is often ignored, although they may be strong mediators of trophic competition and, in some systems, keystone species for driving ecological structure and/or function through acting as a small biomass predator on other larger predatory species within the food web (for example, canine parvovirus in wolves on Isle Royale) (for example, Ray et al. 2005)
- Several studies identify that predator population must reach a certain threshold level at which they become ecologically effective at creating trophic and ecosystem changes, but no one is attempting to determine the threshold level and its effect on humans and livestock (Ray et al. 2005, Letnic et al. 2007, Estes et al. 2011, Ripple et al. 2013)

- Researchers even disagree on the appropriate definitions of and factors involved in ecological functions, trophic cascades, and intraguild predation causing miscommunication among researchers, sampling of inappropriate factors, and misinterpretation of and challenges to cited correlations (Ray et al. 2005, Ripple et al. 2016)
- Poor population sampling to reflect true presence/absence and abundance, resulting in misinterpretations of results, and differences in sampling protocols among studies, making comparisons difficult (for example, Vance-Chalcraft et al. 2007, Wallach et al. 2008, Allen et al. 2014)
- Publication bias, where only positive results are published, may result in important information being withheld that could provide insight into the findings of other studies (Polis et al. 2000, Brashares et al. 2010)
- Not considering adaptive behavior for predator avoidance (for example, changing circadian patterns of activity or habitats used or climbing trees) or increasing predator efficiencies (for example, scavenging), and morphological and biological traits (such as toxic chemicals used by brightly patterned skunks) (for example, Schmitz et al. 2004, Peckarsky et al. 2008, Berger-Tal et al. 2010)
- Many papers repeatedly use the same few examples of trophic cascades, such as studies conducted in Yellowstone NP, Isle Royale, orca-otters-urchins-kelp (for example, Ray et al. 2005, Peckarsky et al. 2008, Estes et al, 2011, Allen et al. 2014, Allen et al. 2017)
- Confusing the roles of, failing to consider, or making inappropriate interpretations of immigration and emigration to account for changes in consumer, competitor or prey abundance; the levels and rates of immigration is very difficult to measure (for example, Duffy 2003, Ray et al. 2005, Briggs and Borer 2005)
- Few studies have attempted to evaluate or quantify the short term and long terms costs of loss of apex predators and mesopredator release (Brashares et al. 2010)
- Confusing and misinterpreting the trophic level and functions that a particular predator plays in a specific food web that may poorly reflect on actual roles in nature (Polis et al. 1989, Ray et al. 2005, Ripple et al. 2016)
- The differences in studying large carnivore-driven system structure and function in relatively unchanging and protected areas in which they were previously extirpated and rapidly reintroduced for management purposes (for example, wolves in Yellowstone National Park), areas in which large carnivores gradually immigrated that are dynamic and largely impacted by humans (for example, wolves in Wisconsin and Minnesota immigrating into areas with high levels of habitat fragmentation and human and livestock densities), urban areas with high levels of human-provided subsidies and habitats, human persecution, intense levels of habitat fragmentation, and/or high levels of subsidized carnivorous pets exist, and neotropical islands (e.g., Ripple and Beschta 2007, Berger et al. 2008, Beschta and Ripple 2012, Fischer et al. 2012, Newsome et al. 2015)

- The repeated citation of a few studies as examples throughout the literature, some of which have been challenged regarding validity of interpretations of results or factors considered (Peckarsky et al. 2008, Prugh et al. 2009, Allen et al. 2017)
- Consideration of whether ecological change to system structure and function occur in a smooth dynamic way or reach thresholds at which major, and possibly irreversible, shifts and perturbations occur (for example Ray et al. 2005, Estes et al. 2011, Ripple et al. 2016).

What Relevant Commonly Cited Articles Are Not Included in Summary Because of Study Discrepancies?

Several commonly cited papers in support of the occurrence of trophic cascades in terrestrial systems have serious discrepancies that create problems with the use of their results.

- **Clark (1972):** This early study collected field data on coyote densities, food habits, fecundity, and population growth in relation to prey densities. Documented limitations of the study included inconsistent time spent looking for dens between year, and small sample sizes for the size of the breeding female cohort and litter sizes. Despite these methodology weaknesses, this paper is often cited for its conclusion that long term coyote densities in the Great Basin of Utah appeared to be partly a function of food base, in this case jackrabbits. The study suggests that coyotes did not control jackrabbit populations.
- **Henke and Bryant (1999):** This study conducted in Texas involved heavy removal of coyotes with between 26 and 55 coyotes removed every third month between 1990 and 1992, reducing coyote density from approximately 0.12 coyotes/km^2 to 0.001 coyotes/km^2 (coyote density on untreated control area was 0.14 coyotes/km^2). In addition to such heavy and chronic removals, the authors suggest caution should be used in interpreting the results reported of a substantial decrease in rodent prey richness within nine months of coyote removals. A drought occurred in 1989 through 1990, which decreased forage and may have facilitated dominance of the highly competitive Ord's kangaroo rat over other species present before treatment began. Also, the authors state that logistical and financial constraints limited the number of replications performed, resulting in a low statistical power associated with the results. However, they state that the "weight of evidence" suggested that coyotes exerted top-down influence on the prey community with only weak empirical evidence. The authors also stated that, to consistently lower coyote densities, an annual removal rate of at least 75% is needed.
- **Mezquida et al. (2006):** This paper discusses a potential negative effect of coyote control on sage grouse conservation through release of mesopredators (foxes, badgers, and ravens) that prey on sage grouse and eggs, depending heavily on Henke and Bryant (1999) and an internal unpublished report prepared by the wildlife biologist at a large private ranch in Utah (Danvir 2000). Rather than coyote predation being either directly or indirectly involved in adversely or positively affecting sage grouse, Danvir (2000) actually places the primary concern with heavy jackrabbit browsing in sagebrush habitat. Golden eagles,

another predator of sage grouse, and coyote abundance seemingly increased in response to variability of jackrabbits and ground squirrels. His final conclusion is that he did not consider predator-prey interactions to be the cause of the increase in sage grouse, instead emphasizing the habitat manipulations that had been performed on the ranch to benefit sage grouse was the primary factor. Danvir (2000) suggests that weather drives sage grouse population dynamics relating to vulnerability to predators, especially in winters with deep snow and during spring nesting season, and that the way sagebrush steppe ecosystems are managed related to the quality of sage grouse habitat can magnify or minimize the effects of severe droughts, severe winters, and predation.

- **Atwood and Gese (2007):** In Yellowstone NP after wolf reintroduction, socially dominant coyotes (alpha and beta) responded to wolf presence by increasing the proportion of time spent vigilant while scavenging, with alphas more diligent than betas. Alphas fed first on carcasses, then betas, then others. Increased vigilance, reduced foraging time, changes in group size and configuration, pre-emptive aggression, and retreat to refugia are crucial behaviors to mediating interspecific interactions. Coyotes would aggressively confront wolves, with numerical advantage by coyotes and the stage of carcass consumption influencing whether coyotes were able to displace wolves. In confrontation bouts that coyotes won, both alpha coyotes were present, there were more coyotes than wolves, and wolves were not very invested in winning. These observations are on one wolf pack and should not be generalized to coyote-wolf interactions at a broader scale without further study.
- **Miller et al. (2012):** This paper suggested that coyotes avoided a wolf den, and that coyote predation on rodents away from the wolf den indicated a top-down effect by wolves on coyotes and subsequently on rodents, claiming that restoration of wolves could be a powerful tool for regulating predation at lower trophic levels. The authors argue that making comparisons over time as wolf numbers increase, especially when coupled with spatial comparisons in the study area, can provide evidence that the changes are due to the treatment, and not another confounding factor. These conclusions are based on studying coyote interactions with one wolf den in Grand Teton NP, which is not a sufficient sample size for making conclusions with any correlational strength.
- **Allen et al. (2014):** In Australia, three particular published case studies are commonly cited in support of the mesopredator release theory. Problems exist in each study, including use of circumstantial evidence for MPR of introduced red fox or feral cat coinciding with dingo control. The authors conclude that an absence of reliable evidence that top predator control induced MPR. In the last 10 years, 22 literature reviews and extended opinion pieces were published. Only three of the 22 discussed caveats or methodological limitations of these three case studies, while other call them anecdotal or circumstantial. Pettigrew (1993) concluded that shooting dingoes increased abundance of feral cats. Abundance sampling was imprecise (800 cats removed from trees, but only 229 observed in sampling surveys), and large bursts of cat abundance occurred in years following rainfall-induced increases in prey availability. Cats shot were prime adults,

indicating a large-scale immigration of nonresident cats rather than increased rapid reproduction. Lundi-Jenkins et al. (1993) stated that dingo control resulted in fox detection and extinction of a protected species after dingo control. The study was small scale and the experimental design insufficient for inferring changes in predator population abundance. To suggest that lethal dingo control caused a MPR of foxes from a single opportunistic observation of fox tracks is to extend inferences far beyond the limitations of the data. To infer from the data that dingo control caused the local extinction of the protected species does not recognize the persistence of a nearby colony that did not go extinct in response to baiting but was destroyed by wildfire. Christensen and Burrows (1995) stated that dingo and fox poisoning resulting in an increase in feral cat abundance. The experimental design (imprecise sampling of predator populations) precludes reliable inference because increases in cat abundance coincided with the beginning of 1080 baiting (which does not target cats) after cessation of cyanide baiting (which targets cats, dingoes, and foxes), substantial rainfall events increasing prey densities, and a change in the physical location of the unbaited treatment area, all confounding the results. The three case studies provide no reliable evidence of MPR because of little reliable evidence that dingo populations were affected by the control to any substantial degree, limitations to the experimental designs and predator sampling methods meant that the studies were incapable of reliably evaluating predator responses to dingo control, and MPR remains only one of several plausible explanations for the observations. Although broad patterns among top predator, mesopredators, and their prey have been demonstrated in some contexts and there are good reasons to suspect that these processes also occur for dingoes, MPR cannot be reliably separated from other equally plausible alternative explanations for the suggested interrelationships among dingoes, foxes, and cats. The authors advocate for evidence-based wildlife management approaches that do not unduly risk valuable environmental and economic resources, such as threatened species and livestock.

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